TSC 6800 Mnemonic Assembler

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SL68-26

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The TSC 6800 Mnemonic Assembler was written for maximum flexibility making it usable to owners of RAM-only systems as well as disk system owners. As always, flexibility adds complexity and therefore the user is advised to read the following application notes thoroughly before trying to use this program.

It is assumed that the user is familiar with assembly language and, in particular, the mnemonics of the M68ØØ assembly language. Those who are not are referred to the "M68ØØ Microprocessor Programming Manual" or the "M68ØØ Programming Reference Manual," both available from your Motorola distributor.

The source language (input) for the TSC 68ØØ Mnemonic Assembler consists of a subset of the 7-bit ASCII (American Standard Code for Information Interchange, 1968) character set. Special meaning is attached to many of these characters as will be described later. In all cases the parity bit (most significant bit) of each character must be Ø. This restriction, of course, does not apply to line numbers, if present.

Each line of source for the assembler consists of any number of bytes (possibly none) preceeding the first character of the source statement, followed by the source statement, followed by a carriage return (hex ØD). The source statement consists of up to four "fields" which are free format. From left to right, the four fields are label , operator (mnemonic),

operand, and comment. There must be at least one space between each of these fields. Further restrictions and options for each of these fields are:

label field

1) The label must begin in the first column and must be unique.
2) Labels consist of letters (A-Z) and numerals (Ø-9).
3) Every label must begin with a letter (A-Z).
4) Only the first 6 characters of any label are significant, the rest are ignored.
5) The label field may be the only field present.

operator field

1) The operator is 3 alphabetic characters (A-Z) which must be followed by a space. The exception to this is number 2, below.
2) Mnemonics such as LDA A and AND B may be written as LDAA and ANDB, respectively. In this case fourth character must be followed by a space.

operand field

1) The operand field may consist of an addressing mode indicator and an expression or just an expression.
2) The addressing mode indicator is either a # (Pound sign) followed by an expression for immediate addression or an expression followed by ,X for indexed addression. (Expressions defined later.)
3) An operand may or may not be required depending on the addressing mode.

comment field

1) The comment field is optional

2) Comments may contain any character from SPACE ($2Ø) to DEL ($7F).

Expressions

Expressions consist of combinations of numbers and symbols seperated by one of the four arithmetic operators +, - , *, /. The arithmetic is done with 16 bit integer operands and truncated as necessary. 8 bit results are taken from the least significant 8 bits. Unary (+) and (-) are allowed. Expressions must not contain spaces.

Numbers

Numbers are groupings of the numerals Ø-9 and possibly letters prefixed or postfixed by a base indicator. Possible base indicators are shown below. The ASCII base allows a single ASCII character ($2Ø-$5F) to be used as an operand when preceeded by a single quote.

Base	Prefix	Postfix	Comment
Decimal	none	none	decimal assumed
Binary	%	B	Ø, 1 allowed
Octal	@	O or Q	Ø-7 allowed
Hexadecimal	$	H	Ø-9, A-F allowed
ASCII	'	not allowed	ASCII equivalence

Symbols

Symbols are groupings of letters and numerals the first 6 of which are significant and the first of which must be a letter. The single character * is a special symbol whose value is the current value of the program counter (PC).

Evaluation of Symbols and Expressions

Since this is a two pass assembler all symbols must be resolved in the two passes. Therefore, only one level of forward referencing is allowed.

Assembler Directives

In addition to the 72 M6800 mnemonics this assembler supports 11 assembler directives or pseudo-ops. These pseudo-ops are listed below along with a brief description. More detailed descriptions follow.

FCC	form constant character
FCB	form constant byte
FDB	form double byte
SPC	insert spaces in output listing
OPT	activate or deactivate assembler options
PAG	skip to next page of output
ORG	define new origin (PC)
EQU	assign value to symbol
END, MON	signal end of source program
NAM, TTL	specify name or title
RMB	reserve memory bytes

FCC

The function of FCC is to create character strings for messages or tables. The character string 'text' is broken down to ASCII, one character per byte. The two allowable formats are shown below:

```
label    FCC    count, text
```

or

```
label    FCC    delimiter text same delimiter
```

where count is any legal expression. In the case where a number is used as a delimiter the first character of text must not be a comma. The character limit of any single FCC statement is 255. The use of label is optional.

FCB

The FCB pseudo-op causes an expression to be evaluated and the resultant 8 bits placed in memory. Usage is shown below:

label FCB expression 1, expression 2,...,expression N

Each expression is seperated by a comma with a maximum of 255 expressions per FCB statement. The label is optional.

FDB

The function of the FDB directive is identical to FCB except 16 bit quantities are assembled, i.e., two bytes generated for each expression. The required format is shown below:

label FDB expression 1, expression 2,...,expression N

where the label is optional. The maximum number of expressions is 127.

SPC

The SPC operator causes the specified number of spaces to be inserted in the output listing. The format is shown below.

SPC expression

Notice that no label is allowed. If 'expression' evaluates to zero one space is inserted. The operator SPC itself does not appear in the output listing. If PAGE mode is selected SPC will not cause spacing past the top of the next page.

OPT

The directive OPT is used to activate or deactivate the assembler options. The format is shown below. Notice that no label is allowed and no code is generated.

```
        OPT     option 1, option 2,...,option N
```

The allowable options are:

SYM	print sorted symbol table after the listing (default)
NOS	do not print the symbol table
GEN	print all code generated by FCB, FDB, and FCC (default)
NOG	print only one line for each FCB, FDB, or FCC
LIS	print the assembled source listing (default)
NOL	suppress the printing of the source listing
PAG	enable page formatting and numbering
NOP	disable page mode (default)
MEM	enable storing of object code in memory
NOM	disable storing of object code in memory (default)
TAP	enable the production of MIKBUG object tape
NOT	disable the production of MIKBUG object tape (default)

If contradicting options appear the last one appearing takes precedence. All options take effect simultaneously at the beginning of pass 2. The default options specified take effect unless the user specifies a particular option. Only the first 3 characters of an option name are significant and multiple options are seperated by a comma. Some of the consequences and uses of the options will be explained later.

PAG

The PAG operator, if the PAG option is on, causes a page eject and subsequently causes the title (if any) and page number to be printed at the top of the next page. No label is allowed and no code is produced. Notice that the first page of any listing is page Ø and no title is printed on that page. The PAG operator itself will not appear in the listing.

The usual procedure is to have all the options and the title declaration followed by a PAG be the first statements in a program.

ORG

The ORG operator, whose format is shown below, causes a new origin address (PC) for the code following.

```
        ORG     expression
```

No label is allowed and no code is produced. If no ORG appears an origin of ØØØØ is assumed.

EQU

EQU is used to equate a symbol to an expression as shown below. A label is required and no code is generated. Only one level of forward referencing is allowed and the equate must not be recursive.

```
label   EQU     expression
```

No code is produced by EQU.

END or MON

These operators signal the assembler that the end of the source input has occurred. No label is allowed and no code is generated.

NAM or TTL

These operators are used to assign a title to be printed at the top of all pages (other than page Ø) if the PAG option is on. If the PAG option is off this operator has no effect. The format, as shown below allows up to 32 characters in the title. No label is allowed

```
        TTL     text for the title
```

and no code is generated. If more than one TTL or NAM operator appears the last one "executed" will be printed on the next page.

RMB

This operator causes the assembler to reserve memory for data storage. No code is produced and therefore the contents of those memory locations are undefined at run time. The label is optional as shown below

```
label   RMB     expression
```

where 'expression' is a 16 bit quantity.

** Description of assembler operation

Pass 1 - PASONE ($03B1)

Pass 1 is used to build the symbol table which is used to resolve forward references. Nothing is printed unless the error limit is exceeded (85). Pass 1 must be run before PASS 2 and again before PASS 3.

Pass 2 - PASTWO ($03D9)

During pass 2 several things may happen.

1) If the LIST option is on, the assembled source listing is printed with error messages, if any.

2) If the LIST option is off only offending source lines and their corresponding error messages are printed.

3) If the TAPE option is on; a MIKBUG formatted object record is outputted (through a different control point than the source listing).

4) If the MEMORY option is on, object code is placed in memory in the following form:

COUNT ADDRESS DATA ... DATA COUNT ADDRESS DATA ... DATA TERM

where ADDRESS is the destination address of the first data following

COUNT is a 16 bit byte count indicating how many data bytes follow

DATA is the actual data

TERM is the record terminator (a COUNT of ØØØØ)

When a count of ØØØØ occurs this signifies the end of the program.

5) If the SYMBOL option is on, a sorted symbol table will be printed after the assembly listing (if any). Pass 1 must be run before PASS 2.

Pass 3 - PASTHR ($05BB)

Pass 3 is used when the user does not have a "punch" device, on which to save the MIKBUG formatted records, which operates independently from the list device. Pass 3 is identical in operation to pass 2 except that NOSYM, NOLIST, NOMEM and TAPE options are forced and error messages are suppressed. Pass 1 must be run before PASS 3, PASS 2 and PASS 3 are independent.

Initialization

There exists in the assembler an initialization routine for each of the passes which must be run once before that pass in run. These are called P1INIT, P2INIT, and P3INIT for passes 1, 2, and 3, respectively.

Adapting to Your System

Due to the inherent flexibility of this assembler it is necessary that each user customize it to fit the particular system. This involves very few changes and can be made by any individual familiar with 6800 assembly language. Each point to be adapted is explained below.

Output Character Routine

The address at $0321 must be changed to that of your Output Character routine. This routine must print the ASCII character in the A register whose parity bit (most significant bit) is zero. The B and X registers must not be altered. If you have a printer or a disk you will likely want to specify the address of a program which handles these peripherals as well as the control terminal.

Tape Output Character Routine

The address at $0324 must be changed to that of your tape punch (or tape record) routine. It is through this control point that the MIKBUG formatted object code is outputted. If you do not have a seperate punch or record device this address may be the same as the Output Character routine address, i.e., tape device same as list device.

Tape Control Characters

There are provisions at $04C0 and $04C4 for four control characters to activate and deactivate, respectively, your punch or record device. Simply place the appropriate control characters for your device in each of the strings. If you desire to send less than the four characters, change the byte at $04B3 to the appropriate value (even Ø). This will, of course, affect both turn on and turn off simultaneously.

Tape Control Delay

The byte at $04C9 controls the number of half-seconds (1MHz clock) of delay between tape turn on and data and also between data and tape turn off. The delay is set now to 2 seconds. If you don't need delay at all set the byte to ØØ.

Page Control

Page Eject

The four bytes at $11D1 are provided for the user to insert the necessary control characters to cause the printer to form feed, i.e., eject to the top of the next page. If you need only 1 character, simply place the Ø4 after that character in the string. The control character is currently set to $ØA (line feed).

Top Margin Control

The byte at $1143 controls the number of lines from the form feed position to the title and page number line (can be Ø).

Page Length Control

The byte at $07C5 controls the number of lines to be printed on each page before the form feed is issued. This count includes the top margin and the title line and should be larger than (top margin + 1).

The user may want to alter other features such as the number of columns printed in the symbol table, etc. Most modifications of this type will be needed by only a few users and therefore will not be elaborated upon here. These users are encouraged to study the code to facilitate making the desired modifications.

Controller Routine

The routine MAIN ($300) is an example of how to use the assembler subroutines. It assumes the user has no independent punch device and therefore must run PASS 3 in order to output the object code. Also, MAIN assumes the source program resides entirely in RAM and that the necessary pointers (to be described) are set.

Disk users will, of course, want to write their own MAIN routine which will bring in each section of source code and run PASS 1 on each, then bring in each section again and run PASS 2, similarly for PASS 3. Naturally, the initiatization routine for each pass need be run only once before each series of passes of the same type. Be reminded that PASS 1 needs to be run before PASS 2 and again before PASS 3. This procedure will allow assembly of files too large to reside entirely in RAM.

One note of caution: the END operator is not strictly necessary at the end of a program as the pass in effect will terminate at the end of the source area. However, if you are generating object code, only an END statement will flush the code buffer or fix the memory count. Likewise, only an END operator will cause the symbol table to be printed (if SYM is on). The byte ENDFLG ($0058) will be set ($FF) if the END operator occurs, which can be detected by your MAIN routine.

Assembler Data Pointers

Before calling any assembler routines the user must set several pointers to data areas. This feature allows much flexibility but restrictions which apply to each pointer are outlined below. No assembler routines modify these pointers.

LBLBEG - $ØØ4Ø

LBLEND - $ØØ42

These are the pointers to the area which will be used for the label table (symbol table). Each entry (symbol) in the table requires 8 bytes. A large table will result in the Put Label and Find Label routines running faster but the Shell (sort) routine will run slower. A small table will have the opposite effect. Of course, the table needs to be large enough to accomodate the number of symbols in your program. A reasonable formula for determining the size necessary is:

SIZE = N * 8 * 2 = N * 16 bytes

where N is an estimate of the number of symbols expected. When the table is full an error message will be inserted in the listing. (The table may not be completely full due to the algorithm used for creating the table - hashing, or scatter storage.)

If you want a 1K symbol table (a recommended minimum, enough for 60-80 labels) you might set LBLBEG to $2ØØØ and LBLEND to $23FF. Notice that the pointers do point to the actual beginning and end of the table.

SRCBEG - $ØØ44

SRCEND - $ØØ46

These two pointers indicate the beginning and end of the section of source code to be assembled, which may be as small as one line of source. SRCEND must point to the carriage return ($ØD) of the last line of the source section to be assembled.

LINBYT - $ØØ48

Although not actually a pointer LINBYT is related to the source pointers. It tells the assembler how many bytes to ignore from carriage return of the previous line (or SRCBEG) before actually processing text. This allows direct output of text editors to be assembled without removing the preceeding line numbers. If you have no line number bytes, set LINBYT to Ø.

MEMPTR - $ØØ49

This pointer tells the assembler where in memory, if the MEMORY option is on, to put the assembled object code. Recall that four extra bytes (address and count) are required for each contiguous block of code.

Error Messages

This assembler supports 12 error messages which are printed after the offending line. The error messages announce violations of any of the restrictions set forth in this manual and are, therefore, self-explanatory.

Additionally, the byte 'ERRORS' (cleared by PIINIT) will be set if any errors have occurred in any of the passes.

Note: The ASCII characters ØØ - $ØC, $ØE - $1F, and $8Ø - $8F, inclusively are explicitly prohibited from being in any area of the source program with the exception of the bytes which are skipped by the assembler (line number bytes). Their existence will cause undefined results. The remaining ASCII characters may appear subject to all of the foregoing restrictions.

Additional Feature

This assembler supports 2 extra mnemonics namely BHS and BLO which are the logical equivalents of BCC and BCS respectively. However, Branch if Higher or Same and Branch if Lower are much easier to remember and use.

Final Note

Please be reminded, when using the MEMORY option, that in most cases the object code will not be put in memory where it can be executed. It is up to the user to write the simple routine necessary to move the code to its proper executable location.

Important: The address at $031C is the address to which control returns when the assembly is complete. This should be modified to suit your needs.

**** USING THE TSC EDITOR ****

The TSC Text Editing System and the TSC Mnemonic Assembler have not been written to be used co-resident. It is possible to use them one after the other without reloading the source. Following is the procedure to be used:

1. Load the editor but before running, change BEGPNT (location $0359) presently $1492 to $1600. This moves the starting location of the text. Put a $ØD at location $15FF.
2. Run the editor and create your file.
3. When finished, exit the editor and write down the contents of
   a.) FILBEG ($0097- 0098) Shows the source beginning.
   b.) FILEND ($0099-009A) Shows one past the source end.
4. Load the assembler but before running be sure to set all pointers.
   a.) Symbol Table limits ($0040-0043)
   b.) Source beginning ($0044-0045) contents of edit FILBEG
   c.) Source ending ($0046-0047) "contents-1" of edit FILEND
       ***** Be sure to subtract one from FILEND !!
   d.) Skip count ($0048) Set this to 03 (3 line no. in editor)
   e.) Memory pointer ($0049) Set if used.
5. Run the assembler.

```
                        *          TSC 6800 RELOCATOR
                        *
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                        *
0200                            ORG     $0200

                        * PROGRAM START

0200 8E 0F FF   START   LDS     #$0FFF      SETUP STACK
0203 7E 03 2F           JMP     BEGIN       START THE PROGRAM

                        * TEMPORARY STORAGE

0206            TAPE    RMB     1           LOADED FROM TAPE FLAG
0207            PLAY    RMB     1           RECORDER ON FLAG
0208            FIXREF  RMB     1           FIX REFERENCES FLAG
0209            TEMP1   RMB     2           TEMPORARY REGISTER
020B            TEMP2   RMB     2           TEMPORARY REGISTER
020D            TEMP3   RMB     2           TEMPORARY REGISTER
020F.           CMPREG  RMB     2           2 BYTE COMPARE REG.
0211            DRCPTR  RMB     2           DIRECT STACK POINTER
0213            OLDPTR  RMB     2           OLD PROGRAM POINTER
0215            NEWPTR  RMB     2           NEW PROGRAM POINTER
0217            OBJEND  RMB     2           END OF OLD PROGRAM
0219            RGBEG   RMB     2           RANGE BEGIN ADDRESS
021B            RGEND   RMB     2           RANGE END ADDRESS
021D            OFFSTL  RMB     1           LEFT HALF OFFSET
021E            OFFSTR  RMB     1           RIGHT HALF OFFSET

                        * EXTERNAL ROUTINE JUMPS

021F 7E E1 D1   OUTCH   JMP     $E1D1       OUTPUT ROUTINE
0222 7E E1 AC   INCH    JMP     $E1AC       INPUT ROUTINE
0225 7E E0 E3   MONITR  JMP     $E0E3       EXIT ADDRESS

                        * PRINT STRINGS

0228 08         PNEXTS  INX
0229 8D 0B      PSTRNG  BSR     PCRLF       PRINT CR AND LF
022B A6 00      PDATA   LDA A   0,X         GET CHARACTER
022D 81 04              CMP A   #4          IS IT EOT?
022F 27 10              BEQ     RETURN
0231 8D EC              BSR     OUTCH       OUTPUT IT
0233 08                 INX
0234 20 F5              BRA     PDATA
0236 FF 02 09   PCRLF   STX     TEMP1       SAVE X REGISTER
0239 CE 05 B8           LDX     #CRLF       POINT TO STRING
023C 8D ED              BSR     PDATA       PRINT THE STRING
023E FE 02 09           LDX     TEMP1       RESTORE X REGISTER
0241 39         RETURN  RTS
```

2000
4A29

```
                        * INPUT 1 HEX CHARACTER

0242 8D DE      IN1HEX  BSR     INCH        GET CHARACTER
0244 80 47      IN1HX1  SUB A   #$47        IS IT VALID?
0246 2A 0D              BPL     INERR
0248 8B 06              ADD A   #6
024A 2A 04              BPL     IN1HX2
024C 8B 07              ADD A   #7
024E 2A 05              BPL     INERR
0250 8B 0A      IN1HX2  ADD A   #10
0252 2B 01              BMI     INERR
0254 39                 RTS                 IF SO, RETURN
0255 31         INERR   INS                 IF NOT, ERROR
0256 31                 INS
0257 7D 02 07           TST     PLAY        IS TAPE ON?
025A 27 05              BEQ     INERR2
025C 31                 INS
025D 31                 INS
025E 7E 02 FA           JMP     ERROR       IF SO, TAPE ERROR
0261 CE 06 AA   INERR2  LDX     #WHAT       ELSE REPORT KEY ERROR
0264 8D C5              BSR     PDATA
0266 20 02              BRA     INADDR      TRY AGAIN

                        * INPUT NUMBER TO X REGISTER

0268 8D BF      PINADD  BSR     PSTRNG      PRINT STRING FIRST
026A 7F 02 09   INADDR  CLR     TEMP1       CLEAR REGISTER
026D 7F 02 0A           CLR     TEMP1+1
0270 8D B0      INADD0  BSR     INCH        GET CHARACTER
0272 81 0D              CMP A   #$0D        IS IT A RETURN?
0274 27 14              BEQ     INADD2      IF SO WE'RE DONE
0276 8D CC              BSR     IN1HX1      ELSE, CHECK FOR HEX
0278 48                 ASL A               SHIFT IT OVER
0279 48                 ASL A
027A 48                 ASL A
027B 48                 ASL A
027C C6 04              LDA B   #4
027E 48         INADD1  ASL A               AND INTO REGISTER
027F 79 02 0A           ROL     TEMP1+1
0282 79 02 09           ROL     TEMP1
0285 5A                 DEC B
0286 26 F6              BNE     INADD1
0288 20 E6              BRA     INADD0      GO GET ANOTHER
028A FE 02 09   INADD2  LDX     TEMP1
028D 39                 RTS

                        * INPUT 2 HEX DIGITS

028E 8D B2      IN2HEX  BSR     IN1HEX      GET 1ST DIGIT
0290 48                 ASL A               SHIFT IT OVER
0291 48                 ASL A
0292 48                 ASL A
0293 48                 ASL A
```

```
0294 16                  TAB             SAVE IT
0295 8D AB               BSR     IN1HEX  GET 2ND CHARACTER
0297 1B                  ABA             ADD IN FIRST
0298 16                  TAB
0299 FB 02 0B            ADD B   TEMP2   ADD TO CHECKSUM
029C F7 02 0B            STA B   TEMP2
029F 39                  RTS

                * LOAD A MIKBUG FORMAT TAPE

02A0 86 3C       LOAD    LDA A   #$3C     SETUP CONTROL PIA
02A2 B7 80 07            STA A   $8007
02A5 CE 05 B1            LDX     #TAPEON PRINT CONTROL CHRS.
02A8 8D 81               BSR     PDATA
02AA BD 02 22    LOAD1   JSR     INCH    GET CHARACTER
02AD 81 53               CMP A   #'S     IS IT AN 'S'?
02AF 26 F9               BNE     LOAD1   LOOP IF NOT
02B1 BD 02 22            JSR     INCH    GET CHARACTER
02B4 81 39               CMP A   #'9     IS IT A '9'?
02B6 27 5D               BEQ     LOAD4   IF SO WE'RE DONE
02B8 80 31               SUB A   #'1     COMPARE TO A '1'
02BA 26 EE               BNE     LOAD1   LOOP IF NOT EQUAL
02BC B7 02 0B            STA A   TEMP2   CLEAR CHECKSUM
02BF 8D CD               BSR     IN2HEX
02C1 80 02               SUB A   #2      GET BYTE COUNT - 2
02C3 B7 02 0C            STA A   TEMP2+1 SAVE IT
02C6 8D C6               BSR     IN2HEX  GET LOAD ADDRESS
02C8 B7 02 09            STA A   TEMP1
02CB 8D C1               BSR     IN2HEX
02CD B7 02 0A            STA A   TEMP1+1
02D0 FE 02 09            LDX     TEMP1
02D3 BD 05 8A            JSR     CMPARE  COMPARE OLDPTR
02D6 22 0E               BHI     LOAD2   JUMP IF OUTSIDE RANGE
02D8 FE 02 17            LDX     OBJEND
02DB BD 05 90            JSR     CMPX    COMPARE ADDRESS & OBJEND
02DE 23 06               BLS     LOAD2   JUMP IF OUTSIDE RANGE
02E0 CE 02 0F            LDX     #CMPREG IF WITHIN RANGE,
02E3 BD 05 A2            JSR     ADDOFF  ADD IN OFFSET
02E6 FE 02 0F    LOAD2   LDX     CMPREG  GET FINAL ADDRESS
02E9 8D A3       LOAD25  BSR     IN2HEX  GET A BYTE
02EB 7A 02 0C            DEC     TEMP2+1 DEC. BYTE COUNT
02EE 27 05               BEQ     LOAD3   EXIT IF = 0
02F0 A7 00               STA A   0,X     ELSE STORE BYTE
02F2 08                  INX
02F3 20 F4               BRA     LOAD25  LOOP UNTIL DONE
02F5 7C 02 0B    LOAD3   INC     TEMP2   IS CHECKSUM RIGHT?
02F8 27 B0               BEQ     LOAD1   IF SO, GET NEXT RECORD
02FA 8D 19       ERROR   BSR     LOAD4   ERROR...TURN OFF TAPE
02FC 8D 26               BSR     DELAY   PAUSE AWHILE
02FE CE 06 90            LDX     #ERR
0301 BD 02 29            JSR     PSTRNG  REPORT ERROR
0304 BD 02 22    TRYAG   JSR     INCH    GET RESPONSE
0307 81 59               CMP A   #'Y
0309 27 07               BEQ     LOAD35  IF YES, TRY AGAIN
```

```
030B 81 4E            CMP A  #'N
030D 26 F5            BNE    TRYAG
030F 7E 02 25         JMP    MONITR     IF NO, EXIT PROGRAM
0312 7E 02 A0 LOAD35  JMP    LOAD
0315 86 34    LOAD4   LDA A  #$34       RESET CONTROL PIA
0317 B7 80 07         STA A  $8007
031A CE 05 B6         LDX    #TAPOFF    PRINT CONTROL CHARS.
031D BD 02 28         JSR    PDATA
0320 BD 02 36         JSR    PCRLF
0323 39               RTS

                * DELAY ROUTINE

0324 CE FF FF DELAY   LDX    #$FFFF
0327 09       DELAY1  DEX                DELAY AWHILE
0328 08               INX
0329 09               DEX
032A 08               INX
032B 09               DEX
032C 26 F9            BNE    DELAY1
032E 39               RTS

                * START OF MAIN PROGRAM

032F BD 02 36 BEGIN   JSR    PCRLF      PRINT 2 LINE FEEDS
0332 BD 02 36         JSR    PCRLF
0335 7F 02 06         CLR    TAPE       CLEAR FLAGS
0338 7F 02 08         CLR    FIXREF
033B 7F 02 07         CLR    PLAY
033E CE 06 AF         LDX    #DRBEG     SETUP DIRECT POINTER
0341 FF 02 11         STX    DRCPTR
0344 CE 05 C2         LDX    #INTRO
0347 BD 02 29         JSR    PSTRNG     PRINT INTRO MESSAGE
034A BD 02 28         JSR    PNEXTS
034D CE 05 EA         LDX    #BEGADR
0350 BD 02 68         JSR    PINADD     GET BEGIN ADDRESS
0353 FF 02 13         STX    OLDPTR
0356 FF 02 19         STX    RGBEG      SET RANGE BEGIN
0359 CE 05 FA         LDX    #ENDADR
035C BD 02 68         JSR    PINADD     GET END ADDRESS
035F FF 02 17         STX    OBJEND
0362 FF 02 1B         STX    RGEND      SET RANGE END
0365 CE 06 0A         LDX    #NEWBG
0368 BD 02 68         JSR    PINADD     GET NEW BEGIN ADDRESS
036B FF 02 15         STX    NEWPTR
036E B6 02 16         LDA A  NEWPTR+1   CALCULATE OFFSET
0371 B0 02 14         SUB A  OLDPTR+1
0374 B7 02 1E         STA A  OFFSTR
0377 B6 02 15         LDA A  NEWPTR
037A B2 02 13         SBC A  OLDPTR
037D B7 02 1D         STA A  OFFSTL
0380 CE 06 3E         LDX    #FIXRFS
0383 BD 02 29         JSR    PSTRNG     ASK TO FIX REFERENCES
0386 BD 02 22         JSR    INCH       GET RESPONSE
```

```
0389 81 4E          CMP A  #'N
038B 27 03          BEQ    LDFRTP
038D 7C 02 08       INC    FIXREF     IF YES, SET FLAG
0390 CE 06 1A LDFRTP LDX   #TAPSTR
0393 BD 02 29       JSR    PSTRNG     LOADING FROM TAPE?
0396 BD 02 22       JSR    INCH       GET RESPONSE
0399 81 59          CMP A  #'Y
039B 27 03          BEQ    LDFRT1
039D 7E 04 26       JMP    NOTAPE     IF NOT, JUMP AHEAD
03A0 7C 02 06 LDFRT1 INC   TAPE       IF SO, SET TAPE FLAG
03A3 7C 02 07       INC    PLAY
03A6 BD 02 A0       JSR    LOAD       GO LOAD TAPE
03A9 7F 02 07       CLR    PLAY
03AC BD 03 24       JSR    DELAY      PAUSE AWHILE
03AF CE 06 28       LDX    #LOADED
03B2 BD 02 29       JSR    PSTRNG     REPORT LOAD COMPLETE
03B5 BD 02 22 WAIT  JSR    INCH       GET A CHARACTER
03B8 81 20          CMP A  #$20
03BA 26 F9          BNE    WAIT       BUT ONLY ACCEPT A SPACE
03BC 7D 02 08       TST    FIXREF     FIXING REFERENCES?
03BF 26 03          BNE    TAPFIX
03C1 7E 02 25       JMP    MONITR     IF NOT, EXIT PROGRAM
03C4 FE 02 15 TAPFIX LDX   NEWPTR
03C7 FF 02 13       STX    OLDPTR     IF SO, FIX OLDPTR
03CA CE 02 17       LDX    #OBJEND
03CD BD 05 A2       JSR    ADDOFF     AND OBJECT END

                    * ENTER DIRECT DATA BLOCKS

03D0 CE 06 AF DRBLKS LDX   #DRBEG
03D3 FF 02 0D       STX    TEMP3      SAVE DIRECT BEGIN
03D6 CE 06 4F       LDX    #DRCTBK
03D9 BD 02 29       JSR    PSTRNG     ANY DIRECT RELOCATES?
03DC BD 02 22       JSR    INCH
03DF 81 4E          CMP A  #'N
03E1 26 05          BNE    DRBLK1     IF SO GO GET THEM
03E3 CE FF FF       LDX    #$FFFF
03E6 20 63          BRA    DIFFRG     IF NOT, JUMP AHEAD
03E8 BD 02 36 DRBLK1 JSR   PCRLF
03EB CE 05 EA       LDX    #BEGADR
03EE BD 02 68       JSR    PINADD     GET BLOCK BEGIN
03F1 8C FF FF       CPX    #$FFFF     FINISHED?
03F4 27 55          BEQ    DIFFRG     IF SO, JUMP AHEAD
03F6 8D 0A          BSR    ENTER      PUT ADDRESS ON STACK
03F8 CE 05 FA       LDX    #ENDADR
03FB BD 02 68       JSR    PINADD     GET BLOCK END
03FE 8D 02          BSR    ENTER      PUT IT ON STACK
0400 20 E6          BRA    DRBLK1     LOOP BACK
0402 7D 02 06 ENTER TST    TAPE       LOADED FROM TAPE?
0405 27 09          BEQ    ENTER0     IF NOT GO AHEAD
0407 CE 02 09       LDX    #TEMP1
040A BD 05 A2       JSR    ADDOFF     IF SO, ADD OFFSET
040D FE 02 09       LDX    TEMP1
0410 FF 02 0B ENTER0 STX   TEMP2      SAVE ADDRESS
```

```
0413 FE 02 0D          LDX    TEMP3      POINT TO DIRECT STACK
0416 B6 02 0B          LDA A  TEMP2      PUT ADDRESS ON STACK
0419 A7 00             STA A  0,X
041B B6 02 0C          LDA A  TEMP2+1
041E A7 01             STA A  1,X
0420 08        ENTER1  INX               FIX DIRECT STACK PTR.
0421 09                INX
0422 FF 02 0D          STX    TEMP3
0425 39                RTS
0426 7D 02 08  NOTAPE  TST    FIXREF     FIXING REFERENCES?
0429 26 A5             BNE    DRBLKS     IF SO, GO ENTER DIRECTS
042B CE 00 00          LDX    #$0000     IF NOT, MAKE THE
042E FF 06 AF          STX    DRBEG      ENTIRE RAM SPACE INTO
0431 CE FF FF          LDX    #$FFFF     A DIRECT RELOCATE BLOCK
0434 FF 06 B1          STX    DRBEG+2
0437 FF 06 B3          STX    DRBEG+4
043A 20 30             BRA    LOOP       START RELOCATION

                * ROUTINE TO INCREMENT POINTERS

043C FE 02 15  INCPTR  LDX    NEWPTR
043F 08                INX               INCREMENT NEW POINTER
0440 FF 02 15          STX    NEWPTR
0443 FE 02 13          LDX    OLDPTR
0446 08                INX               INCREMENT OLD POINTER
0447 FF 02 13          STX    OLDPTR
044A 39                RTS

                * CHANGE REFERENCE RANGE ROUTINE

044B 8D C3     DIFFRG  BSR    ENTER0     SET DIRECT STACK END
044D CE 06 5D          LDX    #CHANGE
0450 BD 02 29          JSR    PSTRNG     ASK TO CHANGE RANGE
0453 BD 02 22          JSR    INCH       GET RESPONSE
0456 81 59             CMP A  #'Y
0458 26 12             BNE    LOOP       IF NO, START RELOCATION
045A CE 05 EA          LDX    #BEGADR
045D BD 02 68          JSR    PINADD     GET RANGE BEGIN
0460 FF 02 19          STX    RGBEG
0463 CE 05 FA          LDX    #ENDADR
0466 BD 02 68          JSR    PINADD     GET RANGE END
0469 FF 02 1B          STX    RGEND

                * MAIN RELOCATION LOOP

046C FE 02 17  LOOP    LDX    OBJEND     IS OLDPTR > OBJEND?
046F BD 05 8A          JSR    CMPARE
0472 23 03             BLS    LOOP1
0474 7E 05 4.          JMP    DONE       IF SO WE'RE DONE
0477 FE 02 11  LOOP1   LDX    DRCPTR     IS THIS A DIRECT BLOCK?
047A EE 00             LDX    0,X
047C BD 05 8A          JSR    CMPARE
047F 25 03             BCS    LOOP2
0481 7E 05 1E          JMP    DIRECT     IF SO, GO MOVE DIRECT
```

```
0484 A6 00      LOOP2   LDA A   0,X       MOVE OPCODE
0486 FE 02 15           LDX     NEWPTR
0489 A7 00              STA A   0,X
048B FE 02 13           LDX     OLDPTR
048E 84 30              AND A   #$30      CHECK FOR 3 BYTE INST.
0490 81 30              CMP A   #$30
0492 27 29              BEQ     MAYBE3    COULD BE 3 BYTES
0494 A6 00              LDA A   0,X
0496 81 CE              CMP A   #$CE      CHECK FOR LDX #
0498 27 29              BEQ     THREE
049A 81 8C              CMP A   #$8C      CHECK FOR CPX #
049C 27 25              BEQ     THREE
049E 81 8E              CMP A   #$8E      CHECK FOR LDS #
04A0 27 21              BEQ     THREE
04A2 81 5F              CMP A   #$5F      LOOK FOR 2 BYTE INST.
04A4 22 0B              BHI     TWO
04A6 84 F0              AND A   #$F0      LOOK FOR 1 BYTE INST.
04A8 81 20              CMP A   #$20
04AA 27 05              BEQ     TWO

                        * ONE BYTE INSTRUCTION

04AC BD 04 3C   ONE     JSR     INCPTR
04AF 20 BB              BRA     LOOP      GET NEXT INSTRUCTION

                        *TWO BYTE INSTRUCTION

04B1 BD 04 3C   TWO     JSR     INCPTR    POINT TO 2ND BYTE
04B4 A6 00              LDA A   0,X       MOVE IT
04B6 FE 02 15           LDX     NEWPTR
04B9 A7 00              STA A   0,X
04BB 20 EF              BRA     ONE       NEXT INSTRUCTION

04BD A6 00      MAYBE3  LDA A   0,X       CHECK 3 OR 1 BYTE INST.
04BF 85 C0              BIT A   #$C0
04C1 27 E9              BEQ     ONE

                        * THREE BYTE INSTRUCTION

04C3 BD 04 3C   THREE   JSR     INCPTR    POINT TO REFERENCE
04C6 FE 02 19           LDX     RGBEG     IS IT BELOW RANGE BEG?
04C9 FF 02 0F           STX     CMPREG
04CC FE 02 13           LDX     OLDPTR
04CF EE 00              LDX     0,X
04D1 BD 05 90           JSR     CMPX      BCS
04D4 25 3C              BLO     NOFFST    IF SO, NO OFFSET
04D6 FE 02 1B           LDX     RGEND     IS IT ABOVE RANGE END?
04D9 FF 02 0F           STX     CMPREG
04DC FE 02 13           LDX     OLDPTR
04DF EE 00              LDX     0,X
04E1 BD 05 90           JSR     CMPX
04E4 22 2C              BHI     NOFFST    IF SO, NO OFFSET
04E6 FE 02 13           LDX     OLDPTR
04E9 09                 DEX
```

```
04EA A6 00              LDA A  0,X      GET OPCODE
04EC 08                 INX
04ED 81 7E              CMP A  #$7E     IS IT A JUMP?
04EF 27 0A              BEQ    OFFSET   IF SO, DO OFFSET
04F1 84 F0              AND A  #$F0     CHECK FOR PAGE 0 REF.
04F3 81 70              CMP A  #$70
04F5 26 04              BNE    OFFSET
04F7 A6 00              LDA A  0,X
04F9 27 1C              BEQ    NOFST1   IF PAGE 0, NO OFFSET
04FB A6 01      OFFSET  LDA A  1,X      ADD OFFSET TO REFERENCE
04FD BB 02 1E           ADD A  OFFSTR
0500 16                 TAB
0501 A6 00              LDA A  0,X
0503 B9 02 1D           ADC A  OFFSTL
0506 FE 02 15   NEXT    LDX    NEWPTR   STORE RESULT
0509 A7 00              STA A  0,X
050B E7 01              STA B  1,X
050D BD 04 3C           JSR    INCPTR
0510 20 9A              BRA    ONE      GET NEXT INSTRUCTION
0512 FE 02 13   NOFFST  LDX    OLDPTR   NO OFFSET ADDED
0515 A6 00              LDA A  0,X
0517 E6 01      NOFST1  LDA B  1,X
0519 20 E8              BRA    NEXT

                * MOVE DIRECT DATA BLOCK

051B BD 04 3C   DRECT0  JSR    INCPTR   BUMP POINTERS
051E A6 00      DIRECT  LDA A  0,X      MOVE ONE BYTE
0520 FE 02 15           LDX    NEWPTR
0523 A7 00              STA A  0,X
0525 FE 02 17           LDX    OBJEND
0528 BD 05 8A           JSR    CMPARE   END OF PROGRAM?
052B 27 17              BEQ    DONE     IF SO, WE'RE DONE
052D FE 02 11           LDX    DRCPTR   GET BLOCK END ADDRESS
0530 EE 02              LDX    2,X
0532 BD 05 8A           JSR    CMPARE   ARE WE THERE?
0535 26 E4              BNE    DRECT0   IF NOT, MOVE ANOTHER
0537 FE 02 11           LDX    DRCPTR   FIXUP DIRECT POINTER
053A 08                 INX
053B 08                 INX
053C 08                 INX
053D 08                 INX
053E FF 02 11           STX    DRCPTR
0541 7E 04 AC           JMP    ONE      GO TO NORMAL RELOCATION

                * CODE IS RELOCATED, CHECK FDB'S

0544 7D 02 08   DONE    TST    FIXREF   FIXING REFERENCES?
0547 27 2F              BEQ    DONE2    IF NOT, ALL DONE
0549 5F                 CLR B
054A CE 05 84           LDX    #FXFBDS
054D BD 02 29           JSR    PSTRNG   ASK TO FIX FDB'S
0550 BD 02 22           JSR    INCH     GET RESPONSE
0553 81 4E              CMP A  #'N
```

```
0555 27 21              BEQ     DONE2       IF N, ALL DONE
0557 81 59              CMP A   #'Y
0559 27 01              BEQ     DONE0       IF Y, JUMP AHEAD
055B 5C                 INC B               ELSE SET FLAG
055C 37         DONE0   PSH B               SAVE FLAG
055D CE 05 F0           LDX     #BEGADR+6
0560 BD 02 68           JSR     PINADD      GET FDB ADDRESS
0563 33                 PUL B               RESTORE FLAG
0564 8C FF FF           CPX     #$FFFF      ANY MORE FDB'S?
0567 27 0F              BEQ     DONE2       IF NOT, ALL DONE
0569 5D                 TST B               IS FDB WITHIN RANGE?
056A 26 08              BNE     DONE1       IF NOT, NO OFFSET
056C CE 02 09           LDX     #TEMP1
056F 8D 31              BSR     ADDOFF      ELSE ADD IN OFFSET
0571 FE 02 09           LDX     TEMP1
0574 8D 2C      DONE1   BSR     ADDOFF      FIXUP THE FDB
0576 20 E4              BRA     DONE0       ANY MORE?

                * ALL FINISHED ROUTINE

0578 BD 02 36   DONE2   JSR     PCRLF
057B BD 02 36           JSR     PCRLF
057E CE 06 6B           LDX     #FINE
0581 BD 02 29           JSR     PSTRNG      REPORT COMPLETION
0584 BD 02 36           JSR     PCRLF
0587 7E 02 25           JMP     MONITR      EXIT THE PROGRAM

                * TWO BYTE COMPARE ROUTINE

058A FF 02 0F   CMPARE  STX     CMPREG
058D FE 02 13           LDX     OLDPTR
0590 FF 02 09   CMPX    STX     TEMP1       COMPARE CMPREG TO TEMP1
0593 B6 02 09           LDA A   TEMP1
0596 B1 02 0F           CMP A   CMPREG
0599 26 06              BNE     CMPX1
059B B6 02 0A           LDA A   TEMP1+1
059E B1 02 10           CMP A   CMPREG+1
05A1 39         CMPX1   RTS

                * ROUTINE TO ADD IN OFFSET

05A2 A6 01      ADDOFF  LDA A   1,X         GET RIGHT HALF
05A4 BB 02 1E           ADD A   OFFSTR      ADD OFFSET RIGHT
05A7 A7 01              STA A   1,X
05A9 A6 00              LDA A   0,X         GET LEFT HALF
05AB B9 02 1D           ADC A   OFFSTL      ADD OFFSET LEFT
05AE A7 00              STA A   0,X
05B0 39                 RTS


                * STRINGS

05B1 00         TAPEON  FCB     0,0,0,0,4
05B2 00 00
```

change for loader to diff MEMPTR

```
05B4 00 04
05B6 00          TAPOFF  FCB     0,0,0,0,4
05B7 00 00
05B9 00 04
05BB 0D          CRLF    FCB     $D,$A,0,0,0,0,4
05BC 0A 00
05BE 00 00
05C0 00 04
05C2 2A          INTRO   FCC     '* TSC 6800 RELOCATOR *'
05C3 20 54
05C5 53 43
05C7 20 36
05C9 38 30
05CB 30 20
05CD 52 45
05CF 4C 4F
05D1 43 41
05D3 54 4F
05D5 52 20
05D7 2A
05D8 04                  FCB     4
05D9 50                  FCC     'PRESENT PROGRAM: '
05DA 52 45
05DC 53 45
05DE 4E 54
05E0 20 50
05E2 52 4F
05E4 47 52
05E6 41 4D
05E8 3A
05E9 04                  FCB     4
05EA 42          BEGADR  FCC     'BEGIN ADDRESS? '
05EB 45 47
05ED 49 4E
05EF 20 41
05F1 44 44
05F3 52 45
05F5 53 53
05F7 3F 20
05F9 04                  FCB     4
05FA 20          ENDADR  FCC     '  END ADDRESS? '
05FB 20 45
05FD 4E 44
05FF 20 41
0601 44 44
0603 52 45
0605 53 53
0607 3F 20
0609 04                  FCB     4
060A 20          NEWBG   FCC     '       MOVE TO? '
060B 20 20
060D 20 20
060F 20 4D
0611 4F 56
```

```
0613 45 20
0615 54 4F
0617 3F 20
0619 04                 FCB     4
061A 4C         TAPSTR  FCC     'LOAD FROM TAPE? '
061B 4F 41
061D 44 20
061F 46 52
0621 4F 4D
0623 20 54
0625 41 50
0627 45 3F
0629 20
062A 04                 FCB     4
062B 2E         LOADED  FCC     '...LOAD COMPLETED.'
062C 2E 2E
062E 4C 4F
0630 41 44
0632 20 43
0634 4F 4D
0636 50 4C
0638 45 54
063A 45 44
063C 2E
063D 04                 FCB     4
063E 46         FIXRFS  FCC     'FIX REFERENCES? '
063F 49 58
0641 20 52
0643 45 46
0645 45 52
0647 45 4E
0649 43 45
064B 53 3F
064D 20
064E 04                 FCB     4
064F 44         DRCTBK  FCC     'DATA BLOCKS? '
0650 41 54
0652 41 20
0654 42 4C
0656 4F 43
0658 4B 53
065A 3F 20
065C 04                 FCB     4
065D 41         CHANGE  FCC     'ALTER RANGE? '
065E 4C 54
0660 45 52
0662 20 52
0664 41 4E
0666 47 45
0668 3F 20
066A 04                 FCB     4
066B 52         FINE    FCC     'RELOCATION COMPLETED !!!'
066C 45 4C
066E 4F 43
```

```
0670 41 54
0672 49 4F
0674 4E 20
0676 43 4F
0678 4D 50
067A 4C 45
067C 54 45
067E 44 20
0680 21 21
0682 21
0683 04                 FCB     4
0684 46         FXFBDS  FCC     'FIX FDB'
0685 49 58
0687 20 46
0689 44 42
068B 27                 FCB     $27,$53,$3F,$20,4
068C 53 3F
068E 20 04
0690 4C         ERR     FCC     'LOAD ERROR!  TRY AGAIN? '
0691 4F 41
0693 44 20
0695 45 52
0697 52 4F
0699 52 21
069B 20 20
069D 54 52
069F 59 20
06A1 41 47
06A3 41 49
06A5 4E 3F
06A7 20
06A8 07                 FCB     7,4
06A9 04
06AA 07         WHAT    FCB     7,$20,$3F,$20,4
06AB 20 3F
06AD 20 04
06AF            DRBEG   RMB     20

                        END
      NO ERROR(S) DETECTED
```

SYMBOL TABLE:

ADDOFF	05A2	BEGADR	05EA	BEGIN	032F	CHANGE	065D
CMPARE	059A	CMPREG	020F	CMPX	0590	CMPX1	05A1
CRLF	05BB	DELAY	0324	DELAY1	0327	DIFFRG	044B
DIRECT	051E	DONE	0544	DONE0	055C	DONE1	0574
DONE2	0578	DRBEG	06AF	DRBLK1	03E8	DRBLKS	03D0
DRCPTR	0211	DRCTBK	064F	DRECT0	051B	ENDADR	05FA
ENTER	0402	ENTER0	0410	ENTER1	0420	ERR	0690
ERROR	02FA	FINE	0668	FIXREF	0208	FIXRFS	063E
FXFBDS	0684	IN1HEX	0242	IN1HX1	0244	IN1HX2	0250
IN2HEX	028E	INADD0	0270	INADD1	027E	INADD2	028A
INADDR	026A	INCH	0222	INCPTR	043C	INERR	0255
INERR2	0261						

INTRO	05C2	LDFRT1	03A0	LDFRTP	0390	LOAD	02A0	LOAD1	02AA
LOAD2	02E6	LOAD25	02E9	LOAD3	02F5	LOAD35	0312	LOAD4	0315
LOADED	062B	LOOP	046C	LOOP1	0477	LOOP2	0484	MAYBE3	049D
MONITR	0225	NEWBG	060A	NEWPTR	0215	NEXT	0506	NOFFST	0512
NOFST1	0517	NOTAPE	0426	OBJEND	0217	OFFSET	04F8	OFFSTL	021D
OFFSTR	021E	OLDPTR	0213	ONE	04AC	OUTCH	021F	PCRLF	0236
PDATA	0228	PINADD	0268	PLAY	0207	PNEXTS	0228	PSTRNG	0229
RETURN	0241	RGBEG	0219	RGEND	021B	START	0200	TAPE	0206
TAPEON	05B1	TAPFIX	03C4	TAPOFF	0586	TAPSTR	061A	TEMP1	0209
TEMP2	020B	TEMP3	020D	THREE	04C3	TRYAG	0304	TWO	04B1
WAIT	03B5	WHAT	06AA						

OBJECT CODE:

```
S1 09 0200 8E 0F FF 7E 03 2F A8
S1 13 021F 7E E1 D1 7E E1 AC 7E E0 E3 08 8D 0B A6 00 81 04 84
S1 13 022F 27 10 8D EC 08 20 F5 FF 02 09 CE 05 BB 8D ED FE DE
S1 13 023F 02 09 39 8D DE 80 47 2A 0D 8B 06 2A 04 8B 07 2A 83
S1 13 024F 05 8B 0A 2B 01 39 31 31 7D 02 07 27 05 31 31 7E A8
S1 13 025F 02 FA CE 06 AA 8D C5 20 02 8D BF 7F 02 09 7F 02 46
S1 13 026F 0A 8D B0 81 0D 27 14 8D CC 48 48 48 48 C6 04 48 E0
S1 13 027F 79 02 0A 79 02 09 5A 26 F6 20 E6 FE 02 09 39 8D 17
S1 13 028F B2 48 48 48 48 16 8D AB 1B 16 FB 02 0B F7 02 0B FE
S1 13 029F 39 86 3C B7 80 07 CE 05 B1 8D 91 BD 02 22 81 53 C8
S1 13 02AF 26 F9 BD 02 22 81 39 27 5D 80 31 26 EE B7 02 0B 74
S1 13 02BF 8D CD 80 02 B7 02 0C 8D C6 B7 02 09 8D C1 B7 02 6E
S1 13 02CF 0A FE 02 09 BD 05 8A 22 0E FE 02 17 BD 05 90 23 00
S1 13 02DF 06 CE 02 0F BD 05 A2 FE 02 0F 8D A3 7A 02 0C 27 D4
S1 13 02EF 05 A7 00 38 20 F4 7C 02 0B 27 B0 8D 19 8D 26 CE AC
S1 13 02FF 06 90 BD 02 29 BD 02 22 81 59 27 07 81 4E 26 F5 9A
S1 13 030F 7E 02 25 7E 02 A0 86 34 B7 80 07 CE 05 B6 BD 02 D5
S1 13 031F 2B BD 02 36 39 CE FF FF 09 08 09 08 09 26 F9 39 22
S1 13 032F BD 02 36 BD 02 36 7F 02 06 7F 02 08 7F 02 07 CE 6A
S1 13 033F 06 AF FF 02 11 CE 05 C2 BD 02 29 BD 02 28 CE 05 AC
S1 13 034F EA BD 02 68 FF 02 13 FF 02 19 CE 05 FA BD 02 68 67
S1 13 035F FF 02 17 FF 02 1B CE 06 0A BD 02 68 FF 02 15 B6 85
S1 13 036F 02 16 B0 02 14 B7 02 1E B6 02 15 B2 02 13 B7 02 78
S1 13 037F 1D CE 06 3E BD 02 29 BD 02 22 81 4E 27 03 7C 02 FB
S1 13 038F 08 CE 06 1A BD 02 29 BD 02 22 81 59 27 03 7E 04 15
S1 13 039F 26 7C 02 06 7C 02 07 BD 02 A0 7F 02 07 BD 03 24 50
S1 13 03AF CE 06 2B BD 02 29 BD 02 22 81 20 26 F9 7D 02 08 2B
S1 13 038F 26 03 7E 02 25 FE 02 15 FF 02 13 CE 02 17 BD 05 8A
S1 13 03CF A2 CE 06 AF FF 02 0D CE 06 4F BD 02 29 BD 02 22 FB
S1 13 03DF 81 4E 26 05 CE FF FF 20 63 BD 02 36 CE 05 EA BD 52
S1 13 03EF 02 68 8C FF FF 27 55 8D 0A CE 05 FA BD 02 68 8D 72
S1 13 03FF 02 20 E6 7D 02 06 27 09 CE 02 09 BD 05 A2 FE 02 F0
S1 13 040F 09 FF 02 0B FE 02 0D B6 02 0B A7 00 B6 02 0C A7 E2
S1 13 041F 01 08 08 FF 02 0D 39 7D 02 08 26 A5 CE 00 00 FF 52
S1 13 042F 06 AF CE FF FF FF 06 B1 FF 06 B3 20 30 FE 02 15 65
S1 13 043F 08 FF 02 15 FE 02 13 08 FF 02 13 39 8D C3 CE 06 FF
S1 13 044F 5D BD 02 29 BD 02 22 81 59 26 12 CE 05 EA BD 02 E5
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S1 13 045F 68 FF 02 19 CE 05 FA BD 02 68 FF 02 1B FE 02 17 E0
S1 13 046F BD 05 8A 23 03 7E 05 44 FE 02 11 EE 00 BD 05 8A F5
S1 13 047F 25 03 7E 05 1E A6 00 FE 02 15 A7 00 FE 02 13 84 A7
S1 13 048F 30 81 30 27 29 A6 00 81 CE 27 29 81 8C 27 25 81 09
S1 13 049F 8E 27 21 81 5F 22 0B 84 F0 81 20 27 05 BD 04 3C 28
S1 13 04AF 20 BB BD 04 3C A6 00 FE 02 15 A7 00 20 EF A6 00 4A
S1 13 04BF 85 C0 27 E9 BD 04 3C FE 02 19 FF 02 0F FE 02 13 9B
S1 13 04CF EE 00 BD 05 90 25 3C FE 02 1B FF 02 0F FE 02 13 3A
S1 13 04DF EE 00 BD 05 90 22 2C FE 02 13 09 A6 00 08 81 7E B2
S1 13 04EF 27 0A 84 F0 81 70 26 04 A6 00 27 1C A6 01 BB 02 EC
S1 13 04FF 1E 16 A6 00 B9 02 1D FE 02 15 A7 00 E7 01 BD C4 D2
S1 13 050F 3C 20 9A FE 02 13 A6 00 E6 01 20 EB BD 04 3C A6 94
S1 13 051F 00 FE 02 15 A7 00 FE 02 17 BD 05 8A 27 17 FE 02 6B
S1 13 052F 11 EE 02 BD 05 8A 26 E4 FE 02 11 08 08 08 08 FF 31
S1 13 053F 02 11 7E 04 AC 7D 02 08 27 2F 5F CE 06 84 BD 02 14
S1 13 054F 29 BD 02 22 81 4E 27 21 81 59 27 01 5C 37 CE 05 0F
S1 13 055F F0 BD 02 68 33 8C FF FF 27 0F 5D 26 08 CE 02 09 1A
S1 13 056F 8D 31 FE 02 09 8D 2C 20 E4 BD 02 36 BD 02 36 CE 3C
S1 13 057F 06 6B BD 02 29 BD 02 36 7E 02 25 FF 02 0F FE 02 65
S1 13 058F 13 FF 02 09 B6 02 09 B1 02 0F 26 06 B6 02 0A B1 19
S1 13 059F 02 10 39 A6 01 BB 02 1E A7 01 A6 00 B9 02 1D A7 AE
S1 13 05AF 00 39 00 00 00 00 04 00 00 00 00 04 0D 0A 00 00 E0
S1 13 05BF 00 00 04 2A 20 54 53 43 20 36 38 30 30 20 52 45 4B
S1 13 05CF 4C 4F 43 41 54 4F 52 20 2A 04 50 52 45 53 45 4E E9
S1 13 05DF 54 20 50 52 4F 47 52 41 4D 3A 04 42 45 47 49 4E D9
S1 13 05EF 20 41 44 44 52 45 53 53 3F 20 04 20 20 45 4E 44 58
S1 13 05FF 20 41 44 44 52 45 53 53 3F 20 04 20 20 20 20 20 BF
S1 13 060F 20 4D 4F 56 45 20 54 4F 3F 20 04 4C 4F 41 44 20 1A
S1 13 061F 46 52 4F 4D 20 54 41 50 45 3F 20 04 2E 2E 2E 4C 10
S1 13 062F 4F 41 44 20 43 4F 4D 50 4C 45 54 45 44 2E 04 46 AE
S1 13 063F 49 58 20 52 45 46 45 52 45 4E 43 45 53 3F 20 04 A1
S1 13 064F 44 41 54 41 20 42 4C 4F 43 4B 53 3F 20 04 41 4C AF
S1 13 065F 54 45 52 20 52 41 4E 47 45 3F 20 04 52 45 4C 4F 7A
S1 13 066F 43 41 54 49 4F 4E 20 43 4F 4D 50 4C 45 54 45 44 FC
S1 13 067F 20 21 21 21 04 46 49 58 20 46 44 42 27 53 3F 20 34
S1 13 068F 04 4C 4F 41 44 20 45 52 52 4F 52 21 20 20 54 52 82
S1 13 069F 59 20 41 47 41 49 4E 3F 20 07 04 07 20 3F 20 04 7A
S9
```

```
                    *          TSC 6800 RELOCATOR
                    *
                    *        COPYRIGHT (C) 1977 BY
                    *   TECHNICAL SYSTEMS CONSULTANTS, INC.
                    *  P. O.  BOX 2574; W.  LAFAYETTE,  IN 47906
                    *             (317) 742-7509
                    *
0200                          ORG     $0200

                    * PROGRAM START

0200 8E 0F FF       START     LDS     #$0FFF      SETUP STACK
0203 7E 03 2F               JMP     BEGIN       START THE PROGRAM

                    * TEMPORARY STORAGE

0206                TAPE      RMB     1           LOADED FROM TAPE FLAG
0207                PLAY      RMB     1           RECORDER ON FLAG
0208                FIXREF    RMB     1           FIX REFERENCES FLAG
0209                TEMP1     RMB     2           TEMPORARY REGISTER
020B                TEMP2     RMB     2           TEMPORARY REGISTER
020D                TEMP3     RMB     2           TEMPORARY REGISTER
020F.               CMPREG    RMB     2           2 BYTE COMPARE REG.
0211                DRCPTR    RMB     2           DIRECT STACK POINTER
0213                OLDPTR    RMB     2           OLD PROGRAM POINTER
0215                NEWPTR    RMB     2           NEW PROGRAM POINTER
0217                OBJEND    RMB     2           END OF OLD PROGRAM
0219                RGBEG     RMB     2           RANGE BEGIN ADDRESS
021B                RGEND     RMB     2           RANGE END ADDRESS
021D                OFFSTL    RMB     1           LEFT HALF OFFSET
021E                OFFSTR    RMB     1           RIGHT HALF OFFSET

                    * EXTERNAL ROUTINE JUMPS

021F 7E E1 D1       OUTCH     JMP     $E1D1       OUTPUT ROUTINE
0222 7E E1 AC       INCH      JMP     $E1AC       INPUT ROUTINE
0225 7E E0 E3       MONITR    JMP     $E0E3       EXIT ADDRESS

                    * PRINT STRINGS

0228 08             PNEXTS    INX
0229 8D 0B          PSTRNG    BSR     PCRLF       PRINT CR AND LF
022B A6 00          PDATA     LDA A   0,X         GET CHARACTER
022D 81 04                    CMP A   #4          IS IT EOT?
022F 27 10                    BEQ     RETURN
0231 8D EC                    BSR     OUTCH       OUTPUT IT
0233 08                       INX
0234 20 F5                    BRA     PDATA
0236 FF 02 09       PCRLF     STX     TEMP1       SAVE X REGISTER
0239 CE 05 B8                 LDX     #CRLF       POINT TO STRING
023C 8D ED                    BSR     PDATA       PRINT THE STRING
023E FE 02 09                 LDX     TEMP1       RESTORE X REGISTER
0241 39             RETURN    RTS
```

```
                    * INPUT 1 HEX CHARACTER

0242 8D DE      IN1HEX  BSR     INCH        GET CHARACTER
0244 80 47      IN1HX1  SUB A   #$47        IS IT VALID?
0246 2A 0D              BPL     INERR
0248 8B 06              ADD A   #6
024A 2A 04              BPL     IN1HX2
024C 8B 07              ADD A   #7
024E 2A 05              BPL     INERR
0250 8B 0A      IN1HX2  ADD A   #10
0252 2B 01              BMI     INERR
0254 39                 RTS                 IF SO, RETURN
0255 31         INERR   INS                 IF NOT, ERROR
0256 31                 INS
0257 7D 02 07           TST     PLAY        IS TAPE ON?
025A 27 05              BEQ     INERR2
025C 31                 INS
025D 31                 INS
025E 7E 02 FA           JMP     ERROR       IF SO, TAPE ERROR
0261 CE 06 AA   INERR2  LDX     #WHAT       ELSE REPORT KEY ERROR
0264 8D C5              BSR     PDATA
0266 20 02              BRA     INADDR      TRY AGAIN

                    * INPUT NUMBER TO X REGISTER

0268 8D BF      PINADD  BSR     PSTRNG      PRINT STRING FIRST
026A 7F 02 09   INADDR  CLR     TEMP1       CLEAR REGISTER
026D 7F 02 0A           CLR     TEMP1+1
0270 8D B0      INADD0  BSR     INCH        GET CHARACTER
0272 81 0D              CMP A   #$0D        IS IT A RETURN?
0274 27 14              BEQ     INADD2      IF SO WE'RE DONE
0276 8D CC              BSR     IN1HX1      ELSE, CHECK FOR HEX
0278 48                 ASL A               SHIFT IT OVER
0279 48                 ASL A
027A 48                 ASL A
027B 48                 ASL A
027C C6 04              LDA B   #4
027E 48         INADD1  ASL A               AND INTO REGISTER
027F 79 02 0A           ROL     TEMP1+1
0282 79 02 09           ROL     TEMP1
0285 5A                 DEC B
0286 26 F6              BNE     INADD1
0288 20 E6              BRA     INADD0      GO GET ANOTHER
028A FE 02 09   INADD2  LDX     TEMP1
028D 39                 RTS

                    * INPUT 2 HEX DIGITS

028E 8D B2      IN2HEX  BSR     IN1HEX      GET 1ST DIGIT
0290 48                 ASL A               SHIFT IT OVER
0291 48                 ASL A
0292 48                 ASL A
0293 48                 ASL A
```

```
0294 16                  TAB              SAVE IT
0295 8D AB               BSR     IN1HEX   GET 2ND CHARACTER
0297 1B                  ABA              ADD IN FIRST
0298 16                  TAB
0299 FB 02 0B            ADD B   TEMP2    ADD TO CHECKSUM
029C F7 02 0B            STA B   TEMP2
029F 39                  RTS

                * LOAD A MIKBUG FORMAT TAPE

02A0 86 3C      LOAD     LDA A   #$3C     SETUP CONTROL PIA
02A2 B7 80 07            STA A   $8007
02A5 CE 05 B1            LDX     #TAPEON  PRINT CONTROL CHRS.
02A8 8D 81               BSR     PDATA
02AA BD 02 22   LOAD1    JSR     INCH     GET CHARACTER
02AD 81 53               CMP A   #'S      IS IT AN 'S'?
02AF 26 F9               BNE     LOAD1    LOOP IF NOT
02B1 BD 02 22            JSR     INCH     GET CHARACTER
02B4 81 39               CMP A   #'9      IS IT A '9'?
02B6 27 5D               BEQ     LOAD4    IF SO WE'RE DONE
02B8 80 31               SUB A   #'1      COMPARE TO A '1'
02BA 26 EE               BNE     LOAD1    LOOP IF NOT EQUAL
02BC B7 02 0B            STA A   TEMP2    CLEAR CHECKSUM
02BF 8D CD               BSR     IN2HEX
02C1 80 02               SUB A   #2       GET BYTE COUNT - 2
02C3 B7 02 0C            STA A   TEMP2+1  SAVE IT
02C6 8D C6               BSR     IN2HEX   GET LOAD ADDRESS
02C8 B7 02 09            STA A   TEMP1
02CB 8D C1               BSR     IN2HEX
02CD B7 02 0A            STA A   TEMP1+1
02D0 FE 02 09            LDX     TEMP1
02D3 BD 05 8A            JSR     CMPARE   COMPARE OLDPTR
02D6 22 0E               BHI     LOAD2    JUMP IF OUTSIDE RANGE
02D8 FE 02 17            LDX     OBJEND
02DB BD 05 90            JSR     CMPX     COMPARE ADDRESS & OBJEND
02DE 23 06               BLS     LOAD2    JUMP IF OUTSIDE RANGE
02E0 CE 02 0F            LDX     #CMPREG  IF WITHIN RANGE,
02E3 BD 05 A2            JSR     ADDOFF   ADD IN OFFSET
02E6 FE 02 0F   LOAD2    LDX     CMPREG   GET FINAL ADDRESS
02E9 8D A3      LOAD25   BSR     IN2HEX   GET A BYTE
02EB 7A 02 0C            DEC     TEMP2+1  DEC. BYTE COUNT
02EE 27 05               BEQ     LOAD3    EXIT IF = 0
02F0 A7 00               STA A   0,X      ELSE STORE BYTE
02F2 08                  INX
02F3 20 F4               BRA     LOAD25   LOOP UNTIL DONE
02F5 7C 02 0B   LOAD3    INC     TEMP2    IS CHECKSUM RIGHT?
02F8 27 B0               BEQ     LOAD1    IF SO, GET NEXT RECORD
02FA 8D 19      ERROR    BSR     LOAD4    ERROR...TURN OFF TAPE
02FC 8D 26               BSR     DELAY    PAUSE AWHILE
02FE CE 06 90            LDX     #ERR
0301 BD 02 29            JSR     PSTRNG   REPORT ERROR
0304 BD 02 22   TRYAG    JSR     INCH     GET RESPONSE
0307 81 59               CMP A   #'Y
0309 27 07               BEQ     LOAD35   IF YES, TRY AGAIN
```

```
030B 81 4E              CMP A  #'N
030D 26 F5              BNE    TRYAG
030F 7E 02 25           JMP    MONITR     IF NO, EXIT PROGRAM
0312 7E 02 A0  LOAD35   JMP    LOAD
0315 86 34     LOAD4    LDA A  #$34       RESET CONTROL PIA
0317 B7 80 07           STA A  $8007
031A CE 05 B6           LDX    #TAPOFF    PRINT CONTROL CHARS.
031D BD 02 2B           JSR    PDATA
0320 BD 02 36           JSR    PCRLF
0323 39                 RTS

                * DELAY ROUTINE

0324 CE FF FF  DELAY    LDX    #$FFFF
0327 09        DELAY1   DEX              DELAY AWHILE
0328 08                 INX
0329 09                 DEX
032A 08                 INX
032B 09                 DEX
032C 26 F9              BNE    DELAY1
032E 39                 RTS

                * START OF MAIN PROGRAM

032F BD 02 36  BEGIN    JSR    PCRLF      PRINT 2 LINE FEEDS
0332 BD 02 36           JSR    PCRLF
0335 7F 02 06           CLR    TAPE       CLEAR FLAGS
0338 7F 02 08           CLR    FIXREF
033B 7F 02 07           CLR    PLAY
033E CE 06 AF           LDX    #DRBEG     SETUP DIRECT POINTER
0341 FF 02 11           STX    DRCPTR
0344 CE 05 C2           LDX    #INTRO
0347 BD 02 29           JSR    PSTRNG     PRINT INTRO MESSAGE
034A BD 02 28           JSR    PNEXTS
034D CE 05 EA           LDX    #BEGADR
0350 BD 02 68           JSR    PINADD     GET BEGIN ADDRESS
0353 FF 02 13           STX    OLDPTR
0356 FF 02 19           STX    RGBEG      SET RANGE BEGIN
0359 CE 05 FA           LDX    #ENDADR
035C BD 02 68           JSR    PINADD     GET END ADDRESS
035F FF 02 17           STX    OBJEND
0362 FF 02 1B           STX    RGEND      SET RANGE END
0365 CE 06 0A           LDX    #NEWBG
0368 BD 02 68           JSR    PINADD     GET NEW BEGIN ADDRESS
036B FF 02 15           STX    NEWPTR
036E B6 02 16           LDA A  NEWPTR+1   CALCULATE OFFSET
0371 B0 02 14           SUB A  OLDPTR+1
0374 B7 02 1E           STA A  OFFSTR
0377 B6 02 15           LDA A  NEWPTR
037A B2 02 13           SBC A  OLDPTR
037D B7 02 1D           STA A  OFFSTL
0380 CE 06 3E           LDX    #FIXRFS
0383 BD 02 29           JSR    PSTRNG     ASK TO FIX REFERENCES
0386 BD 02 22           JSR    INCH       GET RESPONSE
```

```
0389 81 4E            CMP A  #'N
038B 27 03            BEQ    LDFRTP
038D 7C 02 08         INC    FIXREF     IF YES, SET FLAG
0390 CE 06 1A LDFRTP  LDX    #TAPSTR
0393 BD 02 29         JSR    PSTRNG     LOADING FROM TAPE?
0396 BD 02 22         JSR    INCH       GET RESPONSE
0399 81 59            CMP A  #'Y
039B 27 03            BEQ    LDFRT1
039D 7E 04 26         JMP    NOTAPE     IF NOT, JUMP AHEAD
03A0 7C 02 06 LDFRT1  INC    TAPE       IF SO, SET TAPE FLAG
03A3 7C 02 07         INC    PLAY
03A6 BD 02 A0         JSR    LOAD       GO LOAD TAPE
03A9 7F 02 07         CLR    PLAY
03AC BD 03 24         JSR    DELAY      PAUSE AWHILE
03AF CE 06 2B         LDX    #LOADED
03B2 BD 02 29         JSR    PSTRNG     REPORT LOAD COMPLETE
03B5 BD 02 22 WAIT    JSR    INCH       GET A CHARACTER
03B8 81 20            CMP A  #$20
03BA 26 F9            BNE    WAIT       BUT ONLY ACCEPT A SPACE
03BC 7D 02 08         TST    FIXREF     FIXING REFERENCES?
03BF 26 03            BNE    TAPFIX
03C1 7E 02 25         JMP    MONITR     IF NOT, EXIT PROGRAM
03C4 FE 02 15 TAPFIX  LDX    NEWPTR
03C7 FF 02 13         STX    OLDPTR     IF SO, FIX OLDPTR
03CA CE 02 17         LDX    #OBJEND
03CD BD 05 A2         JSR    ADDOFF     AND OBJECT END

                      * ENTER DIRECT DATA BLOCKS

03D0 CE 06 AF DRBLKS  LDX    #DRBEG
03D3 FF 02 0D         STX    TEMP3      SAVE DIRECT BEGIN
03D6 CE 06 4F         LDX    #DRCTBK
03D9 BD 02 29         JSR    PSTRNG     ANY DIRECT RELOCATES?
03DC BD 02 22         JSR    INCH
03DF 81 4E            CMP A  #'N
03E1 26 05            BNE    DRBLK1     IF SO GO GET THEM
03E3 CE FF FF         LDX    #$FFFF
03E6 20 63            BRA    DIFFRG     IF NOT, JUMP AHEAD
03E8 BD 02 36 DRBLK1  JSR    PCRLF
03EB CE 05 EA         LDX    #BEGADR
03EE BD 02 68         JSR    PINADD     GET BLOCK BEGIN
03F1 8C FF FF         CPX    #$FFFF     FINISHED?
03F4 27 55            BEQ    DIFFRG     IF SO, JUMP AHEAD
03F6 8D 0A            BSR    ENTER      PUT ADDRESS ON STACK
03F8 CE 05 FA         LDX    #ENDADR
03FB BD 02 68         JSR    PINADD     GET BLOCK END
03FE 8D 02            BSR    ENTER      PUT IT ON STACK
0400 20 E6            BRA    DRBLK1     LOOP BACK
0402 7D 02 06 ENTER   TST    TAPE       LOADED FROM TAPE?
0405 27 09            BEQ    ENTER0     IF NOT GO AHEAD
0407 CE 02 09         LDX    #TEMP1
040A BD 05 A2         JSR    ADDOFF     IF SO, ADD OFFSET
040D FE 02 09         LDX    TEMP1
0410 FF 02 0B ENTER0  STX    TEMP2      SAVE ADDRESS
```

```
0413 FE 02 0D           LDX     TEMP3       POINT TO DIRECT STACK
0416 B6 02 0B           LDA A   TEMP2       PUT ADDRESS ON STACK
0419 A7 00              STA A   0,X
041B B6 02 0C           LDA A   TEMP2+1
041E A7 01              STA A   1,X
0420 08         ENTER1  INX                 FIX DIRECT STACK PTR.
0421 08                 INX
0422 FF 02 0D           STX     TEMP3
0425 39                 RTS
0426 7D 02 08   NOTAPE  TST     FIXREF      FIXING REFERENCES?
0429 26 A5              BNE     DRBLKS      IF SO, GO ENTER DIRECTS
042B CE 00 00           LDX     #$0000      IF NOT, MAKE THE
042E FF 06 AF           STX     DRBEG       ENTIRE RAM SPACE INTO
0431 CE FF FF           LDX     #$FFFF      A DIRECT RELOCATE BLOCK
0434 FF 06 B1           STX     DRBEG+2
0437 FF 06 B3           STX     DRBEG+4
043A 20 30              BRA     LOOP        START RELOCATION

                * ROUTINE TO INCREMENT POINTERS

043C FE 02 15   INCPTR  LDX     NEWPTR
043F 08                 INX                 INCREMENT NEW POINTER
0440 FF 02 15           STX     NEWPTR
0443 FE 02 13           LDX     OLDPTR
0446 08                 INX                 INCREMENT OLD POINTER
0447 FF 02 13           STX     OLDPTR
044A 39                 RTS

                * CHANGE REFERENCE RANGE ROUTINE

044B 8D C3      DIFFRG  BSR     ENTER0      SET DIRECT STACK END
044D CE 06 5D           LDX     #CHANGE
0450 BD 02 29           JSR     PSTRNG      ASK TO CHANGE RANGE
0453 BD 02 22           JSR     INCH        GET RESPONSE
0456 81 59              CMP A   #'Y
0458 26 12              BNE     LOOP        IF NO, START RELOCATION
045A CE 05 EA           LDX     #BEGADR
045D BD 02 68           JSR     PINADD      GET RANGE BEGIN
0460 FF 02 19           STX     RGBEG
0463 CE 05 FA           LDX     #ENDADR
0466 BD 02 68           JSR     PINADD      GET RANGE END
0469 FF 02 1B           STX     RGEND

                * MAIN RELOCATION LOOP

046C FE 02 17   LOOP    LDX     OBJEND      IS OLDPTR > OBJEND?
046F BD 05 8A           JSR     CMPARE
0472 23 03              BLS     LOOP1
0474 7E 05 4A           JMP     DONE        IF SO WE'RE DONE
0477 FE 02 11   LOOP1   LDX     DRCPTR      IS THIS A DIRECT BLOCK?
047A EE 00              LDX     0,X
047C BD 05 8A           JSR     CMPARE
047F 25 03              BCS     LOOP2
0481 7E 05 1E           JMP     DIRECT      IF SO, GO MOVE DIRECT
```

```
0484 A6 00      LOOP2   LDA A   0,X       MOVE OPCODE
0486 FE 02 15           LDX     NEWPTR
0489 A7 00              STA A   0,X
048B FE 02 13           LDX     OLDPTR
048E 84 30              AND A   #$30      CHECK FOR 3 BYTE INST.
0490 81 30              CMP A   #$30
0492 27 29              BEQ     MAYBE3    COULD BE 3 BYTES
0494 A6 00              LDA A   0,X
0496 81 CE              CMP A   #$CE      CHECK FOR LDX #
0498 27 29              BEQ     THREE
049A 81 8C              CMP A   #$8C      CHECK FOR CPX #
049C 27 25              BEQ     THREE
049E 81 8E              CMP A   #$8E      CHECK FOR LDS #
04A0 27 21              BEQ     THREE
04A2 81 5F              CMP A   #$5F      LOOK FOR 2 BYTE INST.
04A4 22 0B              BHI     TWO
04A6 84 F0              AND A   #$F0      LOOK FOR 1 BYTE INST.
04A8 81 20              CMP A   #$20
04AA 27 05              BEQ     TWO

                * ONE BYTE INSTRUCTION

04AC BD 04 3C   ONE     JSR     INCPTR
04AF 20 BB              BRA     LOOP      GET NEXT INSTRUCTION

                *TWO BYTE INSTRUCTION

04B1 BD 04 3C   TWO     JSR     INCPTR    POINT TO 2ND BYTE
04B4 A6 00              LDA A   0,X       MOVE IT
04B6 FE 02 15           LDX     NEWPTR
04B9 A7 00              STA A   0,X
04BB 20 EF              BRA     ONE       NEXT INSTRUCTION

04BD A6 00      MAYBE3  LDA A   0,X       CHECK 3 OR 1 BYTE INST.
04BF 85 C0              BIT A   #$C0
04C1 27 E9              BEQ     ONE

                * THREE BYTE INSTRUCTION

04C3 BD 04 3C   THREE   JSR     INCPTR    POINT TO REFERENCE
04C6 FE 02 19           LDX     RGBEG     IS IT BELOW RANGE BEG?
04C9 FF 02 0F           STX     CMPREG
04CC FE 02 13           LDX     OLDPTR
04CF EE 00              LDX     0,X
04D1 BD 05 90           JSR     CMPX      BCS
04D4 25 3C              BLO     NOFFST    IF SO, NO OFFSET
04D6 FE 02 1B           LDX     RGEND     IS IT ABOVE RANGE END?
04D9 FF 02 0F           STX     CMPREG
04DC FE 02 13           LDX     OLDPTR
04DF EE 00              LDX     0,X
04E1 BD 05 90           JSR     CMPX
04E4 22 2C              BHI     NOFFST    IF SO, NO OFFSET
04E6 FE 02 13           LDX     OLDPTR
04E9 09                 DEX
```

```
04EA A6 00              LDA A  0,X      GET OPCODE
04EC 08                 INX
04ED 81 7E              CMP A  #$7E     IS IT A JUMP?
04EF 27 0A              BEQ    OFFSET   IF SO, DO OFFSET
04F1 84 F0              AND A  #$F0     CHECK FOR PAGE 0 REF.
04F3 81 70              CMP A  #$70
04F5 26 04              BNE    OFFSET
04F7 A6 00              LDA A  0,X
04F9 27 1C              BEQ    NOFST1   IF PAGE 0, NO OFFSET
04FB A6 01      OFFSET  LDA A  1,X      ADD OFFSET TO REFERENCE
04FD BB 02 1E           ADD A  OFFSTR
0500 16                 TAB
0501 A6 00              LDA A  0,X
0503 B9 02 1D           ADC A  OFFSTL
0506 FE 02 15   NEXT    LDX    NEWPTR   STORE RESULT
0509 A7 00              STA A  0,X
050B E7 01              STA B  1,X
050D BD 04 3C           JSR    INCPTR
0510 20 9A              BRA    ONE      GET NEXT INSTRUCTION
0512 FE 02 13   NOFFST  LDX    OLDPTR   NO OFFSET ADDED
0515 A6 00              LDA A  0,X
0517 E6 01      NOFST1  LDA B  1,X
0519 20 E8              BRA    NEXT

                * MOVE DIRECT DATA BLOCK

051B BD 04 3C   DRECT0  JSR    INCPTR   BUMP POINTERS
051E A6 00      DIRECT  LDA A  0,X      MOVE ONE BYTE
0520 FE 02 15           LDX    NEWPTR
0523 A7 00              STA A  0,X
0525 FE 02 17           LDX    OBJEND
0528 BD 05 8A           JSR    CMPARE   END OF PROGRAM?
052B 27 17              BEQ    DONE     IF SO, WE'RE DONE
052D FE 02 11           LDX    DRCPTR   GET BLOCK END ADDRESS
0530 EE 02              LDX    2,X
0532 BD 05 8A           JSR    CMPARE   ARE WE THERE?
0535 26 E4              BNE    DRECT0   IF NOT, MOVE ANOTHER
0537 FE 02 11           LDX    DRCPTR   FIXUP DIRECT POINTER
053A 08                 INX
053B 08                 INX
053C 08                 INX
053D 08                 INX
053E FF 02 11           STX    DRCPTR
0541 7E 04 AC           JMP    ONE      GO TO NORMAL RELOCATION

                * CODE IS RELOCATED, CHECK FDB'S

0544 7D 02 08   DONE    TST    FIXREF   FIXING REFERENCES?
0547 27 2F              BEQ    DONE2    IF NOT, ALL DONE
0549 5F                 CLR B
054A CE 06 84           LDX    #FXFBDS
054D BD 02 29           JSR    PSTRNG   ASK TO FIX FDB'S
0550 BD 02 22           JSR    INCH     GET RESPONSE
0553 81 4E              CMP A  #'N
```

```
0555 27 21              BEQ     DONE2       IF N, ALL DONE
0557 81 59              CMP A   #'Y
0559 27 01              BEQ     DONE0       IF Y, JUMP AHEAD
055B 5C                 INC B               ELSE SET FLAG
055C 37          DONE0  PSH B               SAVE FLAG
055D CE 05 F0           LDX     #BEGADR+6
0560 BD 02 68           JSR     PINADD      GET FDB ADDRESS
0563 33                 PUL B               RESTORE FLAG
0564 8C FF FF           CPX     #$FFFF      ANY MORE FDB'S?
0567 27 0F              BEQ     DONE2       IF NOT, ALL DONE
0569 5D                 TST B               IS FDB WITHIN RANGE?
056A 26 08              BNE     DONE1       IF NOT, NO OFFSET
056C CE 02 09           LDX     #TEMP1
056F 8D 31              BSR     ADDOFF      ELSE ADD IN OFFSET
0571 FE 02 09           LDX     TEMP1
0574 8D 2C       DONE1  BSR     ADDOFF      FIXUP THE FDB
0576 20 E4              BRA     DONE0       ANY MORE?

                 * ALL FINISHED ROUTINE

0578 BD 02 36    DONE2  JSR     PCRLF
057B BD 02 36           JSR     PCRLF
057E CE 06 6B           LDX     #FINE
0581 BD 02 29           JSR     PSTRNG      REPORT COMPLETION
0584 BD 02 36           JSR     PCRLF
0587 7E 02 25           JMP     MONITR      EXIT THE PROGRAM

                 * TWO BYTE COMPARE ROUTINE

058A FF 02 0F    CMPARE STX     CMPREG
058D FE 02 13           LDX     OLDPTR
0590 FF 02 09    CMPX   STX     TEMP1       COMPARE CMPREG TO TEMP1
0593 B6 02 09           LDA A   TEMP1
0596 B1 02 0F           CMP A   CMPREG
0599 26 06              BNE     CMPX1
059B B6 02 0A           LDA A   TEMP1+1
059E B1 02 10           CMP A   CMPREG+1
05A1 39          CMPX1  RTS

                 * ROUTINE TO ADD IN OFFSET

05A2 A6 01       ADDOFF LDA A   1,X         GET RIGHT HALF
05A4 BB 02 1E           ADD A   OFFSTR      ADD OFFSET RIGHT
05A7 A7 01              STA A   1,X
05A9 A6 00              LDA A   0,X         GET LEFT HALF
05AB B9 02 1D           ADC A   OFFSTL      ADD OFFSET LEFT
05AE A7 00              STA A   0,X
05B0 39                 RTS


                 * STRINGS

05B1 00          TAPEON FCB     0,0,0,0,4
05B2 00 00
```

change for load to diff MEMPTR

```
05B4 00 04
05B6 00          TAPOFF  FCB     0,0,0,0,4
05B7 00 00
05B9 00 04
05BB 0D          CRLF    FCB     $D,$A,0,0,0,0,4
05BC 0A 00
05BE 00 00
05C0 00 04
05C2 2A          INTRO   FCC     '* TSC 6800 RELOCATOR *'
05C3 20 54
05C5 53 43
05C7 20 36
05C9 38 30
05CB 30 20
05CD 52 45
05CF 4C 4F
05D1 43 41
05D3 54 4F
05D5 52 20
05D7 2A
05D8 04                  FCB     4
05D9 50                  FCC     'PRESENT PROGRAM: '
05DA 52 45
05DC 53 45
05DE 4E 54
05E0 20 50
05E2 52 4F
05E4 47 52
05E6 41 4D
05E8 3A
05E9 04                  FCB     4
05EA 42          BEGADR  FCC     'BEGIN ADDRESS? '
05EB 45 47
05ED 49 4E
05EF 20 41
05F1 44 44
05F3 52 45
05F5 53 53
05F7 3F 20
05F9 04                  FCB     4
05FA 20          ENDADR  FCC     '  END ADDRESS? '
05FB 20 45
05FD 4E 44
05FF 20 41
0601 44 44
0603 52 45
0605 53 53
0607 3F 20
0609 04                  FCB     4
060A 20          NEWBG   FCC     '       MOVE TO? '
060B 20 20
060D 20 20
060F 20 4D
0611 4F 56
```

```
0613 45 20
0615 54 4F
0617 3F 20
0619 04              FCB    4
061A 4C       TAPSTR FCC    'LOAD FROM TAPE? '
061B 4F 41
061D 44 20
061F 46 52
0621 4F 4D
0623 20 54
0625 41 50
0627 45 3F
0629 20
062A 04              FCB    4
062B 2E       LOADED FCC    '...LOAD COMPLETED.'
062C 2E 2E
062E 4C 4F
0630 41 44
0632 20 43
0634 4F 4D
0636 50 4C
0638 45 54
063A 45 44
063C 2E
063D 04              FCB    4
063E 46       FIXRFS FCC    'FIX REFERENCES? '
063F 49 58
0641 20 52
0643 45 46
0645 45 52
0647 45 4E
0649 43 45
064B 53 3F
064D 20
064E 04              FCB    4
064F 44       DRCTBK FCC    'DATA BLOCKS? '
0650 41 54
0652 41 20
0654 42 4C
0656 4F 43
0658 4B 53
065A 3F 20
065C 04              FCB    4
065D 41       CHANGE FCC    'ALTER RANGE? '
065E 4C 54
0660 45 52
0662 20 52
0664 41 4E
0666 47 45
0668 3F 20
066A 04              FCB    4
066B 52       FINE   FCC    'RELOCATION COMPLETED !!!'
066C 45 4C
066E 4F 43
```

```
0670 41 54
0672 49 4F
0674 4E 20
0676 43 4F
0678 4D 50
067A 4C 45
067C 54 45
067E 44 20
0680 21 21
0682 21
0683 04                 FCB     4
0684 46         FXFBDS  FCC     'FIX FDB'
0685 49 58
0687 20 46
0689 44 42
068B 27                 FCB     $27,$53,$3F,$20,4
068C 53 3F
068E 20 04
0690 4C         ERR     FCC     'LOAD ERROR!  TRY AGAIN? '
0691 4F 41
0693 44 20
0695 45 52
0697 52 4F
0699 52 21
069B 20 20
069D 54 52
069F 59 20
06A1 41 47
06A3 41 49
06A5 4E 3F
06A7 20
06A8 07                 FCB     7,4
06A9 04
06AA 07         WHAT    FCB     7,$20,$3F,$20,4
06AB 20 3F
06AD 20 04
06AF            DRBEG   RMB     20

                        END
      NO ERROR(S) DETECTED
```

SYMBOL TABLE:

ADDOFF 05A2	BEGADR 05EA	BEGIN 032F	CHANGE 065D	CMPARE 059A
CMPREG 020F	CMPX 0590	CMPX1 05A1	CRLF 05BB	DELAY 0324
DELAY1 0327	DIFFRG 044B	DIRECT 051E	DONE 0544	DONE0 055C
DONE1 0574	DONE2 0578	DRBEG 06AF	DRBLK1 03E8	DRBLKS 03D0
DRCPTR 0211	DRCTBK 064F	DRECT0 051B	ENDADR 05FA	ENTER 0402
ENTER0 0410	ENTER1 0420	ERR 0690	ERROR 02FA	FINE 0668
FIXREF 0208	FIXRFS 063E	FXFBDS 0684	IN1HEX 0242	IN1HX1 0244
IN1HX2 0250	IN2HEX 028E	INADD0 0270	INADD1 027E	INADD2 028A
INADDR 026A	INCH 0222	INCPTR 043C	INERR 0255	INERR2 0261

INTRO	05C2	LDFRT1	03A0	LDFRTP	0390	LOAD	02A0	LOAD1	02AA
LOAD2	02E6	LOAD25	02E9	LOAD3	02F5	LOAD35	0312	LOAD4	0315
LOADED	062B	LOOP	046C	LOOP1	0477	LOOP2	0484	MAYBE3	04BD
MONITR	0225	NEWBG	060A	NEWPTR	0215	NEXT	0506	NOFFST	0512
NOFST1	0517	NOTAPE	0426	OBJEND	0217	OFFSET	04F8	OFFSTL	021D
OFFSTR	021E	OLDPTR	0213	ONE	04AC	OUTCH	021F	PCRLF	0236
PDATA	022B	PINADD	0268	PLAY	0207	PNEXTS	0228	PSTRNG	0229
RETURN	0241	RGBEG	0219	RGEND	021B	START	0200	TAPE	0206
TAPEON	05B1	TAPFIX	03C4	TAPOFF	05B6	TAPSTR	061A	TEMP1	0209
TEMP2	020B	TEMP3	020D	THREE	04C3	TRYAG	0304	TWO	04B1
WAIT	03B5	WHAT	06AA						

OBJECT CODE:

```
S1 09 0200 8E 0F FF 7E 03 2F A8
S1 13 021F 7E E1 D1 7E E1 AC 7E E0 E3 08 8D 0B A6 00 81 04 84
S1 13 022F 27 10 8D EC 08 20 F5 FF 02 09 CE 05 BB 8D ED FE DE
S1 13 023F 02 09 39 8D DE 80 47 2A 0D 8B 06 2A 04 8B 07 2A 83
S1 13 024F 05 8B 0A 2B 01 39 31 31 7D 02 07 27 05 31 31 7E A8
S1 13 025F 02 FA CE 06 AA 8D C5 20 02 8D BF 7F 02 09 7F 02 46
S1 13 026F 0A 8D B0 81 0D 27 14 8D CC 48 48 48 48 C6 04 48 E0
S1 13 027F 79 02 0A 79 02 09 5A 26 F6 20 E6 FE 02 09 39 8D 17
S1 13 028F B2 48 48 48 48 16 8D AB 1B 16 FB 02 0B F7 02 0B FE
S1 13 029F 39 86 3C B7 80 07 CE 05 B1 8D 81 BD 02 22 81 53 CB
S1 13 02AF 26 F9 BD 02 22 81 39 27 5D 80 31 26 EE B7 02 0B 74
S1 13 02BF 8D CD 80 02 B7 02 0C 8D C6 B7 02 09 8D C1 B7 02 6E
S1 13 02CF 0A FE 02 09 BD 05 8A 22 0E FE 02 17 BD 05 90 23 00
S1 13 02DF 06 CE 02 0F BD 05 A2 FE 02 0F 8D A3 7A 02 0C 27 D4
S1 13 02EF 05 A7 00 38 20 F4 7C 02 0B 27 B0 8D 19 8D 26 CE AC
S1 13 02FF 06 90 BD 02 29 BD 02 22 81 59 27 07 81 4E 26 F5 9A
S1 13 030F 7E 02 25 7E 02 A0 86 34 B7 80 07 CE 05 B6 BD 02 D5
S1 13 031F 2B BD 02 36 39 CE FF FF 09 08 09 08 09 26 F9 39 22
S1 13 032F BD 02 36 BD 02 36 7F 02 06 7F 02 08 7F 02 07 CE 6A
S1 13 033F 06 AF FF 02 11 CE 05 C2 BD 02 29 BD 02 28 CE 05 AC
S1 13 034F EA BD 02 68 FF 02 13 FF 02 19 CE 05 FA BD 02 68 67
S1 13 035F FF 02 17 FF 02 1B CE 06 0A BD 02 68 FF 02 15 B6 85
S1 13 036F 02 16 B0 02 14 B7 02 1E B6 02 15 B2 02 13 B7 02 78
S1 13 037F 1D CE 06 3E BD 02 29 BD 02 22 81 4E 27 03 7C 02 FB
S1 13 038F 08 CE 06 1A BD 02 29 BD 02 22 81 59 27 03 7E 04 15
S1 13 039F 26 7C 02 06 7C 02 07 BD 02 A0 7F 02 07 BD 03 24 50
S1 13 03AF CE 06 2B BD 02 29 BD 02 22 81 20 26 F9 7D 02 08 2B
S1 13 03BF 26 03 7E 02 25 FE 02 15 FF 02 13 CE 02 17 BD 05 8A
S1 13 03CF A2 CE 06 AF FF 02 0D CE 06 4F BD 02 29 BD 02 22 FB
S1 13 03DF 81 4E 26 05 CE FF FF 20 63 BD 02 36 CE 05 EA BD 52
S1 13 03EF 02 68 8C FF FF 27 55 8D 0A CE 05 FA BD 02 68 8D 72
S1 13 03FF 02 20 E6 7D 02 06 27 09 CE 02 09 BD 05 A2 FE 02 F0
S1 13 040F 09 FF 02 0B FE 02 0D B6 02 0B A7 00 B6 02 0C A7 E2
S1 13 041F 01 08 08 FF 02 0D 39 7D 02 08 26 A5 CE 00 00 FF 32
S1 13 042F 06 AF CE FF FF FF 96 B1 FF 06 B3 20 30 FE 02 15 65
S1 13 043F 08 FF 02 15 FE 02 13 08 FF 02 13 39 8D C3 CE 06 FF
S1 13 044F 5D BD 02 29 BD 02 22 81 59 26 12 CE 05 EA BD 02 E5
```

```
S1 #  addr  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15 16 C.S.
S1 13 045F 68 FF 02 19 CE 05 FA BD 02 68 FF 02 1B FE 02 17 E0
S1 13 046F BD 05 8A 23 03 7E 05 44 FE 02 11 EE 00 BD 05 8A F5
S1 13 047F 25 03 7E 05 1E A6 00 FE 02 15 A7 00 FE 02 13 84 A7
S1 13 048F 30 81 30 27 29 A6 00 81 CE 27 29 81 8C 27 25 81 09
S1 13 049F 8E 27 21 81 5F 22 0B 84 F0 81 20 27 05 BD 04 3C 28
S1 13 04AF 20 BB BD 04 3C A6 00 FE 02 15 A7 00 20 EF A6 00 4A
S1 13 04BF 85 C0 27 E9 BD 04 3C FE 02 19 FF 02 0F FE 02 13 9B
S1 13 04CF EE 00 BD 05 90 25 3C FE 02 1B FF 02 0F FE 02 13 3A
S1 13 04DF EE 00 BD 05 90 22 2C FE 02 13 09 A6 00 08 81 7E B2
S1 13 04EF 27 0A 84 F0 81 70 26 04 A6 00 27 1C A6 01 BB 02 EC
S1 13 04FF 1E 16 A6 00 B9 02 1D FE 02 15 A7 00 E7 01 BD 04 D2
S1 13 050F 3C 20 9A FE 02 13 A6 00 E6 01 20 EB BD 04 3C A6 94
S1 13 051F 00 FE 02 15 A7 00 FE 02 17 BD 05 8A 27 17 FE 02 6B
S1 13 052F 11 EE 02 BD 05 8A 26 E4 FE 02 11 08 08 08 08 FF 31
S1 13 053F 02 11 7E 04 AC 7D 02 08 27 2F 5F CE 06 84 BD 02 14
S1 13 054F 29 BD 02 22 81 4E 27 21 81 59 27 01 5C 37 CE 05 0F
S1 13 055F F0 BD 02 68 33 8C FF FF 27 0F 5D 26 08 CE 02 09 1A
S1 13 056F 8D 31 FE 02 09 8D 2C 20 E4 BD 02 36 BD 02 36 CE 3C
S1 13 057F 06 6B BD 02 29 BD 02 36 7E 02 25 FF 02 0F FE 02 65
S1 13 058F 13 FF 02 09 B6 02 09 B1 02 0F 26 06 B6 02 0A B1 19
S1 13 059F 02 10 39 A6 01 BB 02 1E A7 01 A6 00 B9 02 1D A7 AE
S1 13 05AF 00 39 00 00 00 00 04 00 00 00 00 04 0D 0A 00 00 E0
S1 13 05BF 00 00 04 2A 20 54 53 43 20 36 38 30 30 20 52 45 4B
S1 13 05CF 4C 4F 43 41 54 4F 52 20 2A 04 50 52 45 53 45 4E E9
S1 13 05DF 54 20 50 52 4F 47 52 41 4D 3A 04 42 45 47 49 4E D9
S1 13 05EF 20 41 44 44 52 45 53 53 3F 20 04 20 20 45 4E 44 58
S1 13 05FF 20 41 44 44 52 45 53 53 3F 20 04 20 20 20 20 20 BF
S1 13 060F 20 4D 4F 56 45 20 54 4F 3F 20 04 4C 4F 41 44 20 1A
S1 13 061F 46 52 4F 4D 20 54 41 50 45 3F 20 04 2E 2E 2E 4C 10
S1 13 062F 4F 41 44 20 43 4F 4D 50 4C 45 54 45 44 2E 04 46 AE
S1 13 063F 49 58 20 52 45 46 45 52 45 4E 43 45 53 3F 20 04 A1
S1 13 064F 44 41 54 41 20 42 4C 4F 43 4B 53 3F 20 04 41 4C AF
S1 13 065F 54 45 52 20 52 41 4E 47 45 3F 20 04 52 45 4C 4F 7A
S1 13 066F 43 41 54 49 4F 4E 20 43 4F 4D 50 4C 45 54 45 44 FC
S1 13 067F 20 21 21 21 04 46 49 58 20 46 44 42 27 53 3F 20 34
S1 13 068F 04 4C 4F 41 44 20 45 52 52 4F 52 21 20 20 54 52 82
S1 13 069F 59 20 41 47 41 49 4E 3F 20 07 04 07 20 3F 20 04 7A
S9
```

```
LOCN B1 B2 B3
                    *
                    *
                    * TSC 6800 ASSEMBLER SYSTEM
                    *  COPYRIGHT 1977 (C) BY
                    *
                    * TECHNICAL SYSTEMS CONSULTANTS, INC.
                    * PO BOX 2574
                    * WEST LAFAYETTE, INDIANA 47906
                    *
                    *



                    *
                    * INSTRUCTION TYPES
                    *  TYPE 1     INHERENT
                    *  TYPE 2     RELATIVE
                    *  TYPE 3     INDEXED,EXTENDED   0,1
                    *  TYPE 4     DIRECT,INDEXED,EXTENDED   0,1,2
                    *  TYPE 5     IMMEDIATE,DIRECT,INDEXED,EXTENDED  0,1,2,3
                    *  TYPE 6     INHERENT (A,B),INDEXED,EXTENDED 0,1,2,3
                    *  TYPE 7     INHERENT (A,B)  0,1
                    *  TYPE 8     FCC
                    *  TYPE 9     FCB
                    *  TYPE 10    FDB
                    *  TYPE 11    SPC
                    *  TYPE 12    OPT
                    *  TYPE 13    PAG
                    *  TYPE 14    ORG
                    *  TYPE 15    EQU
                    *  TYPE 16    END,MON
                    *  TYPE 17    NAM,TTL
                    *  TYPE 18    RMB
                    *
                    *
                    *  ERROR TYPES
                    *
                    *  0   SYMBOL TABLE FULL
                    *  1   UNDEFINED SYMBOL
                    *  2   MULTIPLY DEFINED SYMBOL
                    *  3   UNRECOGNIZABLE MNEMONIC
                    *  4   ILLEGAL CHARACTER IN LABEL
                    *  5   ILLEGAL CHARACTER IN OPERAND
                    *  6   RELATIVE BRANCH TOO LONG
                    *  7   SYNTAX ERROR
                    *  8   ILLEGAL INDEX VARIABLE
                    *  9   ILLEGAL CHARACTER FOR SPECIFIED BASE
                    * 10   ILLEGAL OPTION SWITCH
                    * 11   TOO MANY OPERANDS IN DATA STATEMENT
                    *
                    *
                    *  STORAGE
                          ORG     $40
                    *
0040                LBLBEG  RMB     2
0042                LBLEND  RMB     2
```

```
LOCN B1 B2 B3
0044            SRCBEG  RMB     2
0046            SRCEND  RMB     2
0048            LINBYT  RMB     1
0049            MEMOBJ  RMB     2
004B            PC      RMB     2
004D            SRCPTR  RMB     2
004F            LABEL   RMB     6
0055            PRFLG   RMB     1
0056            ERRFLG  RMB     1
0057            MATFLG  RMB     1
0058            ENDFLG  RMB     1
0059            PCFLAG  RMB     1
005A            DATFLG  RMB     1
005B            FCCFLG  RMB     1
005C            EJFLG   RMB     1
005D            P3FLG   RMB     1
005E            PRTFLG  RMB     1
005F            PAGFLG  RMB     1
0060            LBLMSK  RMB     1
0061            CKSUM   RMB     1
0062            OBJINT  RMB     1
0063            OPN     RMB     1
0064            TERM    RMB     1
0065            XSAVE   RMB     2
0067            SPSAVE  RMB     2
0069            XTEMP   RMB     2
006B            XTEMP1  RMB     2
006D            XTEMP2  RMB     2
006F            XTEMP3  RMB     2
0071            XTEMP4  RMB     2
0073            XTEMP5  RMB     2
0075            LTEMP   RMB     2
0077            QTEMP3  RMB     2
0079            QTEMP2  RMB     2
007B            QTEMP   RMB     2
007D            TEMP    RMB     1
007E            OPCODE  RMB     1
007F            OP1     RMB     1
0080            OP2     RMB     1
0081            P2ERR1  RMB     1
0082            P2ERR2  RMB     1
0083            P2ERR3  RMB     1
0084            LSTERR  RMB     1
0085            ERRPTR  RMB     2
0087            BYTPTR  RMB     2
0089            OBJPTR  RMB     2
008B            MEMPTR  RMB     2
008D            LINPTR  RMB     2
008F            PASS    RMB     1
0090            OPCNT   RMB     1
0091            RNDM    RMB     3
0094            OPTPTR  RMB     2
0096            OPNPTR  RMB     2
0098            SAVPTR  RMB     2
009A            MCOUNT  RMB     2
```

```
LOCN B1 B2 B3
009C            LSTPCM  RMB     2
009E            LASTPC  RMB     2
00A0            OBJADR  RMB     2
00A2            LASTM   RMB     2
00A4            HASHCT  RMB     1
00A5            ERRCNT  RMB     1
00A6            BYTCNT  RMB     1
00A7            BUFCNT  RMB     1
00A8            LINCNT  RMB     1
00A9            ERRORS  RMB     1
00AA            GAP     RMB     1
00AB            MODFY   RMB     1
00AC            PAGENO  RMB     2
00AE            LIST    RMB     1
00AF            SYMBOL  RMB     1
00B0            GENER   RMB     1
00B1            PAGER   RMB     1
00B2            TAPE    RMB     1
00B3            MEMORY  RMB     1
00B4            OBJBUF  RMB     18
00C6            TITLE   RMB     33
                *
                *
                *
        0036    LINES   EQU     54
        000A    EJCHR   EQU     $0A
                *
                *
                        ORG     $100
0100            ERRSTK  RMB     256
0200            BYTSTK  RMB     256
                *
                *
0300 8E A0 7F   MAIN    LDS     #$A07F    SET STACK ************
0303 BD 03 26           JSR     P1INIT
0306 BD 03 B1           JSR     PASONE
0309 BD 03 6F           JSR     P2INIT
030C BD 03 D9           JSR     PASTWO
030F BD 03 26           JSR     P1INIT
0312 BD 03 B1           JSR     PASONE
0315 BD 03 6F           JSR     P3INIT
0318 BD 05 BB           JSR     PASTHR
                *
                * EXTERNAL LINKAGES
031B 7E E0 D0   MON     JMP     $E0D0     RETURN TO MONITOR  PROGRAM
031E 86 20      OUTS    LDA A   #' '
0320 7E E1 D1   OUTCH   JMP     $E1D1
0323 7E E1 D1   TAPOUT  JMP     $E1D1
                *
                *
                *
                ** P1INIT
                * PASS 1 INITIALIZATION.  MUST BE
                * RUN BEFORE A SERIES OF PASS 1 RUNS.
0326 86 FF      P1INIT  LDA A   #$FF
```

```
LOCN B1 B2 B3
0328 97 AE              STA A  LIST
032A 97 B0              STA A  GENER
032C 97 AF              STA A  SYMBOL
032E 97 59              STA A  PCFLAG
0330 40                 NEG A
0331 97 A8              STA A  LINCNT     INITIALIZE COUNT
0333 4F                 CLR A
0334 97 B1              STA A  PAGER      SET 'OFF' OPTIONS
0336 97 AC              STA A  PAGENO
0338 97 AD              STA A  PAGENO+1
033A 97 A5              STA A  ERRCNT     SET COUNT
033C 97 56              STA A  ERRFLG     CLEAR FLAG
033E 97 B2              STA A  TAPE
0340 97 B3              STA A  MEMORY
0342 97 58              STA A  ENDFLG     CLR FLAG
0344 97 A9              STA A  ERRORS
0346 86 7F              LDA A  #$7F
0348 97 60              STA A  LBLMSK     SET MASK
034A CE 01 00           LDX    #ERRSTK
034D DF 85              STX    ERRPTR     SET POINTER
034F DE 40              LDX    LBLBEG     GET LABEL TABLE START
0351 6F 00      CLRLBL  CLR    0,X        SET WHOLE TABLE TO 0
0353 08                 INX
0354 9C 42              CPX    LBLEND     CHECK DONE
0356 26 F9              BNE    CLRLBL     LOOP TILL DONE
0358 CE 00 C6           LDX    #TITLE
035B 86 20              LDA A  #'
035D A7 00      SETTL   STA A  0,X
035F 08                 INX
0360 8C 00 E6           CPX    #TITLE+32  CHECK ALL DONE
0363 26 F8              BNE    SETTL      GO FINISH
0365 86 04              LDA A  #4
0367 A7 00              STA A  0,X        SET EOT
0369 CE 00 00           LDX    #0
036C DF 4B              STX    PC         SET PC TO 0
036E 39                 RTS
                *
                *
                ** P2INIT
                * PASS 2 INITIALIZATION.  MUST BE RUN
                * BEFORE A SERIES OF PASS 2 RUNS.
036F 86 FF      P2INIT  LDA A  #$FF
0371 97 62              STA A  OBJINT     SET TOGGLE
0373 97 5D              STA A  P3FLG      SET NOT PASS 3
0375 CE 01 00           LDX    #ERRSTK
0378 DF 85              STX    ERRPTR     INITIALIZE ERROR PTR
037A CE 00 00           LDX    #0
037D DF 4B              STX    PC         INITIALIZE PC
037F CE FF FF           LDX    #$FFFF
0382 DF 9C              STX    LSTPCM
0384 DF 9E              STX    LASTPC     SET OBJECT PC'S
0386 4F                 CLR A
0387 97 A7              STA A  BUFCNT
0389 97 9A              STA A  MCOUNT
038B 97 9B              STA A  MCOUNT+1
```

```
LOCN B1 B2 B3
038D 97 58          STA A  ENDFLG    CLEAR FLAG
038F CE 00 B4       LDX    #OBJBUF
0392 DF 89          STX    OBJPTR    SET OBJECT PTR
0394 DE 49          LDX    MEMOBJ
0396 DF 8B          STX    MEMPTR    SET  MEMORY PTR
0398 DF A2          STX    LASTM
039A DE 40          LDX    LBLBEG    GET LABEL PTR
039C A6 00    SETBIT LDA A  0,X       GET FIRST CHAR
039E 27 04          BEQ    NOLAB     IF 0, NO LABEL
03A0 8A 80          ORA A  #$80      SET FLAG BIT
03A2 A7 00          STA A  0,X       PUT BACK
03A4 C6 08    NOLAB  LDA B  #8        SET COUNT
03A6 08       ADVPTR INX             MOVE PTR
03A7 9C 42          CPX    LBLEND    SEE IF DONE
03A9 27 05          BEQ    P2IN3
03AB 5A             DEC B
03AC 26 F8          BNE    ADVPTR    SEE IF AT NEW POSITION
03AE 20 EC          BRA    SETBIT    GO SET NEXT FLAG
03B0 39       P2IN3  RTS
                    *
                    *
                    ** P3INIT
                    * PASS 3 INITIALIZATION
     036F           P3INIT EQU    P2INIT    SAME AS PASS 2
                    *
                    *
                    ** PASONE
                    * PERFORMS ASSEMBLY PASS 1
03B1 9F 67    PASONE STS    SPSAVE    SAVE SP
03B3 DE 44           LDX    SRCBEG    GET SOURCE POINTER
03B5 09              DEX              ADJUST
03B6 7F 00 8F        CLR    PASS      SET PASS1
03B9 DF 4D    PASS1  STX    SRCPTR    SAVE PTR
03BB BD 0B 75        JSR    PARSE     PARSE UP THE LINE
03BE DF 6F           STX    XTEMP3    SAVE SOURCE POINTER
03C0 96 4F           LDA A  LABEL     GET FIRST CHAR OF LAB.
03C2 27 03           BEQ    PASS11    IF NO LABEL
03C4 BD 08 A2        JSR    PUTLBL    GO INSTALL LABEL
03C7 96 55    PASS11 LDA A  PRFLG     GET PROCESS FLAG
03C9 26 03           BNE    PASS12    IF SET, PROCESS
03CB BD 0C 44        JSR    FND222    GO GET OPERATOR
03CE DE 6F    PASS12 LDX    XTEMP3    GET SOURCE PTR
03D0 96 58           LDA A  ENDFLG
03D2 26 04           BNE    PASS13
03D4 9C 46           CPX    SRCEND    CHECK DNE
03D6 26 E1           BNE    PASS1     IF NOT, LOOP
03D8 39       PASS13 RTS
                    *
                    *
                    *
                    ** PASTWO
                    * PERFORMS ASSEMBLY PASS 2
03D9 DE 44    PASTWO LDX    SRCBEG    POINT TO BEGIN. SOURCE
03DB 09              DEX              ADJUST
03DC 86 01           LDA A  #$01
```

```
LOCN B1 B2 B3
03DE 97 8F          STA A  PASS     SET PASS 2
03E0 DF 4D     PASS2 STX   SRCPTR   SAVE POINTER
03E2 DE 4B          LDX    PC
03E4 DF 6D          STX    XTEMP2   SAVE PC
03E6 DE 4D          LDX    SRCPTR   GET POINTER
03E8 BD 0B 75  PASS2A JSR  PARSE    GO PARSE THE LINE
03EB DF 6F          STX    XTEMP3   SAVE PTR
03ED 96 4F          LDA A  LABEL    GET FIRST CHAR
03EF 27 09          BEQ    PASS2B   IF NOT THERE, SKIP
03F1 BD 09 05       JSR    FNDLBL   LOCATE LABEL
03F4 A6 00          LDA A  0,X      GET FIRST CHAR
03F6 84 7F          AND A  #$7F     RESET BIT
03F8 A7 00          STA A  0,X      PUT BACK
03FA 96 55     PASS2B LDA A  PRFLG   GET PROCESS FLAG
03FC 26 03          BNE    PASS2X   IF SET, DONT PROCESS
03FE BD 09 1F       JSR    FNDOPT   GET OPERATION
0401 96 90     PASS2X LDA A  OPCNT   CHECK BYTE COUNT
0403 27 16          BEQ    PASS2C   IF 0, SKIP
0405 96 5D          LDA A  P3FLG    CHECK PASS 3
0407 27 04          BEQ    OBJGEN   IF SO, GO GENERATE CODE
0409 96 B2          LDA A  TAPE     SEE IF TAPE ON
040B 27 07          BEQ    MEMGEN   IF NOT, CHECK MEMORY
040D BD 14 89  OBJGEN JSR  OBJCOD   GO GENERATE CODE
0410 96 5D          LDA A  P3FLG    CHECK PASS3
0412 27 07          BEQ    PASS2C   IF SO, SKIP MEMORY
0414 96 B3     MEMGEN LDA A  MEMORY  SEE IF MEMORY ON
0416 27 03          BEQ    PASS2C   IF NOT, SKIP
0418 BD 15 77       JSR    MEMCOD   GO PUT IN MEMORY
041B 96 5D     PASS2C LDA A  P3FLG    CHECK PASS3
041D 26 03          BNE    SHORT
041F 7E 04 A4       JMP    NOERR4
0422 96 5E     SHORT  LDA A  PRTFLG   SEE IF PRINT
0424 27 0D          BEQ    CHK2ER   IF NOT, SKIP
0426 96 AE          LDA A  LIST     GET LIST FLAG
0428 27 09          BEQ    CHK2ER   SKIP IF NO LIST
042A 96 90          LDA A  OPCNT
042C 36             PSH A
042D BD 05 C1       JSR    PRTINF   GO PRINT DATA
0430 32             PUL A
0431 97 90          STA A  OPCNT    RESTORE COUNT
0433 86 FF     CHK2ER LDA A  #$FF
0435 97 56          STA A  ERRFLG   SET FLAG
0437 96 A5     CHKERR LDA A  ERRCNT   GET COUNT
0439 27 3A          BEQ    NOERR    IF 0, NO ERRORS
043B DE 85          LDX    ERRPTR   GET POINTER
043D EE 00          LDX    0,X      GET ERR ADDRESS
043F 9C 4D          CPX    SRCPTR   CHECK IF HERE
0441 26 32          BNE    NOERR    IF NOT, NO ERROR
0443 96 AE          LDA A  LIST     GET LIST FLAG
0445 26 06          BNE    GETERR   IF LIST ON, SOURCE PRINTED
0447 BD 05 FF       JSR    PRTDAT   PRINT DATA
044A BD 06 42       JSR    PRTSRC   GO PRINT SOURCE TOO
044D DE 85     GETERR LDX    ERRPTR   GET ERROR PTR
044F 7A 00 A5       DEC    ERRCNT   COUNT ONE DOWN
0452 E6 02          LDA B  2,X      GET TYPE
```

```
LOCN B1 B2 B3
0454 27 15          BEQ    GETER2
0456 D1 81          CMP B  P2ERR1    CHECK SAME
0458 26 03          BNE    CHK2
045A 7F 00 81       CLR    P2ERR1
045D D1 82     CHK2 CMP B  P2ERR2
045F 26 03          BNE    CHK3
0461 7F 00 82       CLR    P2ERR2
0464 D1 83     CHK3 CMP B  P2ERR3
0466 26 03          BNE    GETER2
0468 7F 00 83       CLR    P2ERR3
046B 08        GETER2 INX
046C 08               INX
046D 08               INX
046E DF 85            STX    ERRPTR    STORE NEW PTR
0470 BD 06 51         JSR    PRTERR    GO INSERT ERROR MESSAGE
0473 20 C2            BRA    CHKERR    GO SEE IF MORE ERRORS
0475 CE 00 81  NOERR  LDX    #P2ERR1   POINT TO STORE
0478 86 03            LDA A  #3        SET COUNT
047A 36        CERR   PSH A            SAVE COUNT
047B DF 77            STX    QTEMP3    SAVE PLACE
047D E6 00            LDA B  0,X       GET ERROR
047F 27 15            BEQ    CNXT      IF 0, GO NEXT
0481 96 56            LDA A  ERRFLG    GET FLAG
0483 27 0A            BEQ    PRT2ER
0485 96 AE            LDA A  LIST      CHECK LIST ON
0487 26 06            BNE    PRT2ER
0489 BD 05 FF         JSR    PRTDAT
048C BD 06 42         JSR    PRTSRC    PRINT INFO
048F DE 77     PRT2ER LDX    QTEMP3    GET POINTER
0491 E6 00            LDA B  0,X       GET ERROR
0493 BD 06 51         JSR    PRTERR    GO PRINT MESG
0496 DE 77     CNXT   LDX    QTEMP3    GET POINTER
0498 08               INX              POINT NEXT
0499 32               PUL A  GET COUNT
049A 4A               DEC A            ONE DONE
049B 26 DD            BNE    CERR      LOOP TILL DONE
049D 96 5F     NOERR2 LDA A  PAGFLG    CHECK PAGE FLAG
049F 26 03            BNE    NOERR4
04A1 BD 11 31         JSR    EJECT
04A4 DE 6F     NOERR4 LDX    XTEMP3    GET SOURCE PTR
04A6 96 58            LDA A  ENDFLG
04A8 26 2C            BNE    FIN
04AA 9C 46            CPX    SRCEND    CHECK IF DONE
04AC 27 03            BEQ    P2DON
04AE 7E 03 E0         JMP    PASS2
04B1 39        P2DON  RTS
               *
               ** CONTRL
               * OUTPUT TAPE CONTROL CHARACTERS
04B2 C6 04     CONTRL LDA B  #4        SET 4 CHARS
04B4 27 09            BEQ    CONDON
04B6 A6 00     PCTRL  LDA A  0,X
04B8 BD 03 23         JSR    TAPOUT
04BB 08               INX
04BC 5A               DEC B
```

```
LOCN B1 B2 B3
04BD 26 F7              BNE     PCTRL
04BF 39          CONDON RTS
04C0 00          TAPEON FCB     0,0,0,0
04C1 00
04C2 00
04C3 00
04C4 00          TAPEOF FCB     0,0,0,0
04C5 00
04C6 00
04C7 00
                 *
                 ** DELAY
                 * DELAY FOR TAPE CONTROL
04C8 C6 04       DELAY  LDA B   #4
04CA 27 09              BEQ     DELDON
04CC CE F4 FF    XLOOP  LDX     #$F4FF    SET COUNTER
04CF 09          DECX   DEX
04D0 26 FD              BNE     DECX
04D2 5A                 DEC B
04D3 26 F7              BNE     XLOOP
04D5 39          DELDON RTS
                 *
                 *
                 *
                 ** FIN
                 * END OF ASSEMBLY CLEAN UP
04D6 96 5D       FIN    LDA A   P3FLG     CHECK PASS3
04D8 27 17              BEQ     LSTREC    IF SO, PUNCH LAST RECORD
04DA BD 07 BA           JSR     PCRLF     CR LF
04DD BD 06 39           JSR     PRT2
04E0 CE 05 49           LDX     #NOERHD
04E3 96 A9              LDA A   ERRORS    SEE IF ANY ERRORS
04E5 27 03              BEQ     PRTMES    IF NOT, GOT PTR
04E7 CE 05 4B           LDX     #ERRHD    MESSAGE
04EA BD 07 AB    PRTMES JSR     PDATA     PRINT IT
04ED 96 B2       CHKTAP LDA A   TAPE      SEE IF TAPE ON
04EF 27 14              BEQ     FIN2      IF NOT, SKIP
04F1 BD 15 18    LSTREC JSR     PRTREC    GO PUNCH LAST
04F4 86 53              LDA A   #'S
04F6 BD 03 23           JSR     TAPOUT
04F9 86 39              LDA A   #'9
04FB BD 03 23           JSR     TAPOUT    PUNCH S9
04FE 8D C8              BSR     DELAY     DELAY BEFORE TURN OFF
0500 CE 04 C4           LDX     #TAPEOF
0503 8D AD              BSR     CONTRL
0505 96 5D       FIN2   LDA A   P3FLG     CHECK PASS3
0507 27 2E              BEQ     FIN6      IF SO, SKIP
0509 96 B3              LDA A   MEMORY    CHECK MEMORY OPTION
050B 27 09              BEQ     FIN5      IF OFF, SKIP
050D BD 15 F4           JSR     FIXCNT    GO SET BYTE COUNT
0510 DE 8B              LDX     MEMPTR    GET POINTER
0512 6F 00       SETO   CLR     0,X
0514 6F 01              CLR     1,X
0516 96 AF       FIN5   LDA A   SYMBOL    CHECK SYMBOL ON
0518 26 44              BNE     SYMGEN    IF SO, GO PRINT
```

```
LOCN B1 B2 B3
051A 96 AE              LDA A  LIST     SEE IF LIST ON
051C 27 19              BEQ    FIN6     IF NOT, SKIP
051E BD 07 BA  FIN3     JSR    PCRLF    CR LF
0521 96 B1              LDA A  PAGER    SEE IF PAGE ON
0523 27 0A              BEQ    FIN4     IF NOT, SKIP
0525 96 B1              LDA A  PAGER    SEE IF PAGE ON
0527 27 06              BEQ    FIN4     IF NOT, SKIP
0529 CE 11 D1           LDX    #EJSTR
052C 7E 07 AB           JMP    PDATA    PAGE EJECT
052F C6 04     FIN4     LDA B  #4
0531 BD 07 BA  GAPX     JSR    PCRLF
0534 5A                 DEC B
0535 26 FA              BNE    GAPX     PRINT 4 LINES
0537 39        FIN6     RTS             DONE
0538 20        SYMHD    FCC    '   SYMBOL TABLE:'
0539 20
053A 20
053B 53
053C 59
053D 4D
053E 42
053F 4F
0540 4C
0541 20
0542 54
0543 41
0544 42
0545 4C
0546 45
0547 3A
0548 04                 FCB    4
0549 4E        NOERHD   FCC    'NO'
054A 4F
054B 20        ERRHD    FCC    ' ERROR(S) DETECTED'
054C 45
054D 52
054E 52
054F 4F
0550 52
0551 28
0552 53
0553 29
0554 20
0555 44
0556 45
0557 54
0558 45
0559 43
055A 54
055B 45
055C 44
055D 04                 FCB    4
               *
               *
               ** SYMGEN
```

```
LOCN B1 B2 B3
                    * SORT AND PRINT SYMBOL TABLE
055E 96 5D          SYMGEN  LDA A   P3FLG       CHECK PASS 3
0560 27 BC                  BEQ     FIN3        IF SO, DONE
0562 C6 04                  LDA B   #4
0564 BD 0F D9               JSR     TYP11A      GO SPACE 4
0567 CE 05 38               LDX     #SYMHD
056A BD 07 AB               JSR     PDATA       PRINT HEADER
056D BD 13 F0               JSR     SHELL       GO SORT
0570 DE 40                  LDX     LBLBEG
0572 09                     DEX
0573 DF 69                  STX     XTEMP       SET POINTER
0575 BD 07 BA       LSTSYM  JSR     PCRLF
0578 C6 04                  LDA B   #4          SET 4 LABELS
057A DE 69          GETSYM  LDX     XTEMP       GET POINTER
057C 08                     INX
057D A6 00                  LDA A   0,X
057F 27 29                  BEQ     NOPRT       IF 0, NO LABEL
0581 37                     PSH B
0582 C6 06                  LDA B   #6          SET 6 CHARS
0584 A6 00          LABOUT  LDA A   0,X         GET CHAR
0586 BD 03 20               JSR     OUTCH       PRINT IT
0589 08                     INX
058A 5A                     DEC B               CHECK DONE
058B 26 F7                  BNE     LABOUT
058D BD ~~0C C7~~ 031E      JSR     OUT2S       PRINT 2 SPACES
0590 A6 00                  LDA A   0,X         GET MS ADDRESS
0592 BD 0C D0               JSR     OUTHEX      PRINT IT
0595 08                     INX
0596 A6 00                  LDA A   0,X         GET LS VALUE
0598 BD 0C D0               JSR     OUTHEX      PRINT IT
059B DF 69                  STX     XTEMP       SAVE PTR LOCATION
059D BD 06 ~~39~~ 3C        JSR     PRT2~~7~~3  PRINT ~~7~~5 SPACES
05A0 33                     PUL B               GET LINE COUNT
05A1 9C 42                  CPX     LBLEND      CHECK TABLE DONE
05A3 27 13                  BEQ     SYMPRT
05A5 5A             CONT    DEC B               SEE IF 4 YET
05A6 26 D2                  BNE     GETSYM      IF NOT, DO AGAIN
05A8 20 CB                  BRA     LSTSYM      OTHERWISE, START NEW LINE
05AA 37             NOPRT   PSH B
05AB C6 07                  LDA B   #7
05AD 08             MOVPTR  INX
05AE 5A                     DEC B
05AF 26 FC                  BNE     MOVPTR      ADVANCE PTR
05B1 33                     PUL B
05B2 DF 69                  STX     XTEMP       SAVE PTR
05B4 9C 42                  CPX     LBLEND      CHECK DONE
05B6 26 C2                  BNE     GETSYM
05B8 7E 05 1E       SYMPRT  JMP     FIN3
                    *
                    *
                    ** PASTHR
                    * PERFORM ASSEMBLY PASS 3
05BB 7F 00 5D       PASTHR  CLR     P3FLG       SET PASS 3
05BE 7E 03 D9               JMP     PASTWO      DO PASS 2
                    *
```

```
LOCN B1 B2 B3
                    ** PRTINF
                    * PRINT ASSEMBLED DATA
05C1 8D 3C      PRTINF  BSR     PRTDAT      GO PRINT ADDR, DATA
05C3 8D 7D              BSR     PRTSRC      PRINT SOURCE
05C5 CE 02 00           LDX     #BYTSTK
05C8 DF 71              STX     XTEMP4      SET MULTIPLE DATA PTR
05CA 96 5A              LDA A   DATFLG      CHECK MULTIPLE
05CC 26 01              BNE     PRTINA      IF SET, ITS THERE
05CE 39         PRTIND  RTS                 DONE
05CF 96 B0      PRTINA  LDA A   GENER        CHECK GENERATE FLAG
05D1 27 FB              BEQ     PRTIND      IF CLR, NO PRINT
05D3 96 90      PRTINE  LDA A   OPCNT        GET OPERAND COUNT
05D5 DE 6D      PRTINB  LDX     XTEMP2      GET OLD PC
05D7 08         PRTINC  INX                 BUMP
05D8 4A                 DEC A               DO UNTIL PAST PRINTED
05D9 26 FC              BNE     PRTINC
05DB DF 6D              STX     XTEMP2      SAVE NEW PRINTABLE PC
05DD 86 01              LDA A   #1
05DF 97 90              STA A   OPCNT        SET COUNT
05E1 DE 71              LDX     XTEMP4      GET STACK PTR
05E3 9C 87              CPX     BYTPTR      CHECK FOR DATA
05E5 27 E7              BEQ     PRTIND      IF NO DATA, EXIT
05E7 A6 00              LDA A   0,X         GET CHAR (BYTE)
05E9 97 7E              STA A   OPCODE      PUT IN PLACE
05EB 08                 INX                 BUMP POINTER
05EC 9C 87              CPX     BYTPTR      CHECK MORE DATA
05EE 27 08              BEQ     PRTING      IF NO, DONE
05F0 7C 00 90           INC     OPCNT       SET COUNT =2
05F3 A6 00              LDA A   0,X         GET NEXT BYTE
05F5 97 7F              STA A   OP1         PUT IN PLACE
05F7 08                 INX                 BUMP PTR
05F8 DF 71      PRTING  STX     XTEMP4      SAVE POINTER
05FA BD 05 FF           JSR     PRTDAT      GO PRINT DATA
05FD 20 D4              BRA     PRTINE      LOOP TILL DONE
                    *
                    *
                    ** PRTDAT
                    * PRINT ADDRESS AND DATA
05FF BD 07 BA   PRTDAT  JSR     PCRLF       GO DO CR LF
0602 BD 03 1E           JSR     OUTS        PRINT A SP
0605 96 59              LDA A   PCFLAG      CHECK FOR PRINT PC
0607 26 08              BNE     PRTPC       IF SET, DO IT
0609 BD 0C C7           JSR     OUT2S
060C BD 0C C5           JSR     OUT3S       SKIP FIELD
060F 20 25              BRA     PRT1
0611 96 6D      PRTPC   LDA A   XTEMP2      GET CURRENT PC
0613 BD 0C D0           JSR     OUTHEX      PRINT MS
0616 96 6E              LDA A   XTEMP2+1    GET LS
0618 BD 0C CC           JSR     OUTHXS      PRINT IT
061B D6 90              LDA B   OPCNT       GET COUNT
061D 27 17              BEQ     PRT1
061F 96 7E              LDA A   OPCODE
0621 BD 0C CC           JSR     OUTHXS      PRINT OPCODE
0624 5A                 DEC B
0625 27 12              BEQ     PRT2        SEE IF DONE
```

```
LOCN B1 B2 B3
0627 96 7F          LDA A  OP1          PRINT IT
0629 BD 0C CC       JSR    OUTHXS
062C 5A             DEC B
062D 27 0D          BEQ    PRT3
062F 96 80          LDA A  OP2
0631 BD 0C CC       JSR    OUTHXS
0634 20 09          BRA    PRT4
0636 BD 0C C5  PRT1 JSR    OUT3S
0639 BD 0C C5  PRT2 JSR    OUT3S
063C BD 0C C5  PRT3 JSR    OUT3S
063F 7E 03 1E  PRT4 JMP    OUTS
                    *
                    ** PRTSRC
                    * PRINT A LINE OF SOURCE
0642 DE 8D     PRTSRC LDX  LINPTR      GET POINTER
0644 A6 00     PRTS1  LDA A 0,X        GET A CHAR
0646 08               INX              POINT NEXT
0647 81 0D            CMP A #$D        CHECK FOR CR
0649 27 05            BEQ  PRTS2       IF SO, DONE
064B BD 03 20         JSR  OUTCH       PRINT IT
064E 20 F4            BRA  PRTS1       DO AGAIN
0650 39        PRTS2  RTS              DONE
                    *
                    ** PRTERR
                    * INSERT ERROR MESSAGE INTO LISTING
0651 CE 06 81  PRTERR LDX  #MSGHD
0654 BD 07 B2         JSR  PSTR        PRINT HEADING
0657 7F 00 56         CLR  ERRFLG      SET PRINTED FLAG
065A CE 06 69         LDX  #MSGTBL     POINT TO TABLE
065D 58               ASL B            MULT ERROR # * 2
065E 27 04            BEQ  GOTMSG      CHECK IF GOT
0660 08        PTNXT  INX              POINT NEXT ADDRESS
0661 5A               DEC B            COUNT OFF
0662 26 FC            BNE  PTNXT       CYCLE
0664 EE 00     GOTMSG LDX  0,X         GET TEXT POINTER
0666 7E 07 AB         JMP  PDATA       GO PRINT MESG
                    *
0669 06 87     MSGTBL FDB  MESG0
066B 06 9D            FDB  MESG1
066D 06 AE            FDB  MESG2
066F 06 C6            FDB  MESG3
0671 06 DE            FDB  MESG4
0673 06 F9            FDB  MESG5
0675 07 16            FDB  MESG6
0677 07 2F            FDB  MESG7
0679 07 3C            FDB  MESG8
067B 07 53            FDB  MESG9
067D 07 78            FDB  MESG10
067F 07 8E            FDB  MESG11
                    *
0681 2A        MSGHD  FCC  '**  '
0682 2A
0683 20
0684 20
0685 20
```

```
LOCN B1 B2 B3
0686 04                  FCB    4
                  *
0687 53           MESG0  FCC    'SYMBOL TABLE OVERFLOW'
0688 59
0689 4D
068A 42
068B 4F
068C 4C
068D 20
068E 54
068F 41
0690 42
0691 4C
0692 45
0693 20
0694 4F
0695 56
0696 45
0697 52
0698 46
0699 4C
069A 4F
069B 57
069C 04                  FCB    4
069D 55           MESG1  FCC    'UNDEFINED SYMBOL'
069E 4E
069F 44
06A0 45
06A1 46
06A2 49
06A3 4E
06A4 45
06A5 44
06A6 20
06A7 53
06A8 59
06A9 4D
06AA 42
06AB 4F
06AC 4C
06AD 04                  FCB    4
06AE 4D           MESG2  FCC    'MULTIPLY DEFINED SYMBOL'
06AF 55
06B0 4C
06B1 54
06B2 49
06B3 50
06B4 4C
06B5 59
06B6 20
06B7 44
06B8 45
06B9 46
06BA 49
06BB 4E
```

```
LOCN B1 B2 B3
06BC 45
06BD 44
06BE 20
06BF 53
06C0 59
06C1 4D
06C2 42
06C3 4F
06C4 4C
06C5 04             FCB    4
06C6 55        MESG3  FCC    'UNRECOGNIZABLE MNEMONIC'
06C7 4E
06C8 52
06C9 45
06CA 43
06CB 4F
06CC 47
06CD 4E
06CE 49
06CF 5A
06D0 41
06D1 42
06D2 4C
06D3 45
06D4 20
06D5 4D
06D6 4E
06D7 45
06D8 4D
06D9 4F
06DA 4E
06DB 49
06DC 43
06DD 04             FCB    4
06DE 49        MESG4  FCC    'ILLEGAL CHARACTER IN LABEL'
06DF 4C
06E0 4C
06E1 45
06E2 47
06E3 41
06E4 4C
06E5 20
06E6 43
06E7 48
06E8 41
06E9 52
06EA 41
06EB 43
06EC 54
06ED 45
06EE 52
06EF 20
06F0 49
06F1 4E
06F2 20
```

```
LOCN B1 B2 B3
06F3 4C
06F4 41
06F5 42
06F6 45
06F7 4C
06F8 04                 FCB     4
06F9 49         MESG5   FCC     'ILLEGAL CHARACTER IN OPERAND'
06FA 4C
06FB 4C
06FC 45
06FD 47
06FE 41
06FF 4C
0700 20
0701 43
0702 48
0703 41
0704 52
0705 41
0706 43
0707 54
0708 45
0709 52
070A 20
070B 49
070C 4E
070D 20
070E 4F
070F 50
0710 45
0711 52
0712 41
0713 4E
0714 44
0715 04                 FCB     4
0716 52         MESG6   FCC     'RELATIVE BRANCH TOO LONG'
0717 45
0718 4C
0719 41
071A 54
071B 49
071C 56
071D 45
071E 20
071F 42
0720 52
0721 41
0722 4E
0723 43
0724 48
0725 20
0726 54
0727 4F
0728 4F
0729 20
```

```
LOCN B1 B2 B3
072A 4C
072B 4F
072C 4E
072D 47
072E 04                 FCB     4
072F 53         MESG7   FCC     'SYNTAX ERROR'
0730 59
0731 4E
0732 54
0733 41
0734 58
0735 20
0736 45
0737 52
0738 52
0739 4F
073A 52
073B 04                 FCB     4
073C 49         MESG8   FCC     'ILLEGAL INDEX VARIABLE'
073D 4C
073E 4C
073F 45
0740 47
0741 41
0742 4C
0743 20
0744 49
0745 4E
0746 44
0747 45
0748 58
0749 20
074A 56
074B 41
074C 52
074D 49
074E 41
074F 42
0750 4C
0751 45
0752 04                 FCB     4
0753 49         MESG9   FCC     'ILLEGAL CHARACTER FOR SPECIFIED BASE'
0754 4C
0755 4C
0756 45
0757 47
0758 41
0759 4C
075A 20
075B 43
075C 48
075D 41
075E 52
075F 41
0760 43
```

```
LOCN B1 B2 B3
0761 54
0762 45
0763 52
0764 20
0765 46
0766 4F
0767 52
0768 20
0769 53
076A 50
076B 45
076C 43
076D 49
076E 46
076F 49
0770 45
0771 44
0772 20
0773 42
0774 41
0775 53
0776 45
0777 04          FCB    4
0778 49      MESG10  FCC    'ILLEGAL OPTION SWITCH'
0779 4C
077A 4C
077B 45
077C 47
077D 41
077E 4C
077F 20
0780 4F
0781 50
0782 54
0783 49
0784 4F
0785 4E
0786 20
0787 53
0788 57
0789 49
078A 54
078B 43
078C 48
078D 04          FCB    4
078E 54      MESG11  FCC    'TOO MANY OPERANDS (DATA)'
078F 4F
0790 4F
0791 20
0792 4D
0793 41
0794 4E
0795 59
0796 20
0797 4F
```

```
LOCN B1 B2 B3
0798 50
0799 45
079A 52
079B 41
079C 4E
079D 44
079E 53
079F 20
07A0 28
07A1 44
07A2 41
07A3 54
07A4 41
07A5 29
07A6 04                 FCB     4
                        *
                        ** PDATA
                        * PRINT STRINGS
07A7 BD 03 20   PLOOP   JSR     OUTCH       PRINT CHAR
07AA 08                 INX                 POINT NEXT
07AB A6 00      PDATA   LDA A   0,X         GET A CHAR
07AD 81 04              CMP A   #4          CHECK FOR EOT
07AF 26 F6              BNE     PLOOP       IF NOT,PRINT IT
07B1 39                 RTS                 DONE
                        *
                        ** PSTR
                        * PRINT CR,LF THEN STRING
07B2 DF 65      PSTR    STX     XSAVE       SAVE X
07B4 8D 04              BSR     PCRLF
07B6 DE 65              LDX     XSAVE       GET POINTER BAC K
07B8 20 F1              BRA     PDATA       GO PRINT IT
                        *
                        ** PCRLF
                        * PRINT CR AND LF
07BA CE 07 CF   PCRLF   LDX     #CRLF       POINT
07BD 8D EC              BSR     PDATA       GO PRINT
07BF 96 A8              LDA A   LINCNT      GET LINE COUNT
07C1 4C                 INC A
07C2 97 A8              STA A   LINCNT      BUMP IT
07C4 81 36              CMP A   #LINES      SEE IF TIME TO EJECT
07C6 22 04              BHI     PCRLF2      IF SO, GO DO IT
07C8 7F 00 5C   PCRLF1  CLR     EJFLG       CLEAR FLAG
07CB 39                 RTS                 DONE
07CC 7E 11 31   PCRLF2  JMP     EJECT       GO PAGE EJECT
07CF 0D         CRLF    FCB     $D,$A,0,0,0,0,4
07D0 0A
07D1 00
07D2 00
07D3 00
07D4 00
07D5 04
                        *
                        ** OPSERR
                        * FATAL ERROR ROUTINE
                        * GENERATES 3 NOP'S
```

```
LOCN B1 B2 B3
07D6 36          OPSERR  PSH A
07D7 86 01               LDA A  #01
07D9 97 7E               STA A  OPCODE
07DB 97 7F               STA A  OP1
07DD 97 80               STA A  OP2
07DF 97 59               STA A  PCFLAG     MAKE SURE PC ON
07E1 BD 0C 72            JSR    ADDPC3
07E4 32                  PUL A
                 *
                 ** ASMERR
                 * KEEP TRACK OF ASSEMBLY ERRORS
07E5 36          ASMERR  PSH A
07E6 97 84               STA A  LSTERR     SAVE ERROR
07E8 32                  PUL A
07E9 7D 00 56            TST    ERRFLG     CHECK ERROR SUPPRESS
07EC 26 33               BNE    ASME2      IF ON, DONT PROCESS
07EE C6 FF               LDA B  #$FF
07F0 D7 A9               STA B  ERRORS     SET FLAG
07F2 7D 00 8F            TST    PASS       CHECK PASS COUNT
07F5 26 2D               BNE    ASME3      IF NOT PASS1, SKIP
07F7 D6 A5               LDA B  ERRCNT     GET COUNT
07F9 C1 55               CMP B  #85        CHECK EXCESS
07FB 27 24               BEQ    ASME2      IF SO, IGNORE
07FD 36                  PSH A             SAVE ERROR #
07FE 96 4D               LDA A  SRCPTR     GET HIGH
0800 D6 4E               LDA B  SRCPTR+1   GET LOW
0802 DE 85               LDX    ERRPTR     GET STACK POINTER
0804 A7 00               STA A  0,X        STORE HIGH
0806 E7 01               STA B  1,X        STORE LOW
0808 32                  PUL A             GET ERROR #
0809 A7 02               STA A  2,X        SAVE #
080B 08                  INX
080C 08                  INX
080D 08                  INX               ADVANCE ERROR PTR
080E DF 85               STX    ERRPTR     SAVE IT
0810 96 A5               LDA A  ERRCNT     GET COUNT OF ERRORS
0812 4C                  INC A             KICK
0813 97 A5               STA A  ERRCNT
0815 81 55               CMP A  #85        ERROR LIMIT?
0817 26 08               BNE    ASME2
0819 CE 08 36            LDX    #TOOMAN
081C 8D 94               BSR    PSTR
081E 9E 67               LDS    SPSAVE     GET PROPER RET ADR.
0820 39                  RTS               DONE
0821 86 FF       ASME2   LDA A  #$FF
0823 39                  RTS               DONE
0824 D6 81       ASME3   LDA B  P2ERR1     CHECK EMPTY
0826 26 03               BNE    ASME4
0828 97 81               STA A  P2ERR1
082A 39                  RTS
082B D6 82       ASME4   LDA B  P2ERR2
082D 26 03               BNE    ASME5
082F 97 82               STA A  P2ERR2
0831 39                  RTS
0832 97 83       ASME5   STA A  P2ERR3
```

```
LOCN B1 B2 B3
0834 39                RTS
0835 39                RTS                DONE
0836 45          TOOMAN FCC     'ERROR LIMIT EXCEEDED'
0837 52
0838 52
0839 4F
083A 52
083B 20
083C 4C
083D 49
083E 4D
083F 49
0840 54
0841 20
0842 45
0843 58
0844 43
0845 45
0846 45
0847 44
0848 45
0849 44
084A 04                FCB    4
                *
                ** RANDOM
                * RANDOM NUMBER GENERATOR USED FOR
                * HASHING FUNCTION
084B 37          RANDOM PSH B                 SAVE B
084C 36                 PSH A                 AND A
084D C6 18              LDA B  #24            SET FOR 24 CYCLES
084F 96 91       LOOP   LDA A  RNDM           GET FIRST BYTE
0851 48                 ASL A
0852 48                 ASL A
0853 48                 ASL A
0854 98 91              EOR A  RNDM           XOR BIT 28 WITH 31
0856 48                 ASL A
0857 48                 ASL A                 GET RESULT IN CARRY
0858 79 00 93           ROL    RNDM+2
085B 79 00 92           ROL    RNDM+1
085E 79 00 91           ROL    RNDM           SHIFT ALL LEFT WITH C
0861 5A                 DEC B                 COUNT OFF
0862 26 EB              BNE    LOOP           LOOP UNTIL DONE
0864 32                 PUL A
0865 33                 PUL B
0866 39                 RTS
                *
                ** HASH
                * HASH A SYMBOL TO A TABLE ADDRESS
0867 CE 00 4F    HASH   LDX    #LABEL         GET START OF LABEL
086A 7F 00 A4           CLR    HASHCT         SET HASH COUNTER TO 0
086D A6 00              LDA A  0,X            GET FIRST CHAR
086F AB 05              ADD A  5,X
0871 97 93              STA A  RNDM+2         FOLD THE LABEL
0873 A6 01              LDA A  1,X
0875 A9 04              ADC A  4,X
```

```
LOCN B1 B2 B3
0877 97 92              STA A  RNDM+1
0879 A6 02              LDA A  2,X
087B A9 03              ADC A  3,X
087D 97 91              STA A  RNDM      AND PUT IN RANDOM GEN
087F 7C 00 A4  REHASH   INC    HASHCT    KICK COUNTER
0882 BD 08 4B  MIX2     JSR    RANDOM    MIX EM UP
0885 96 93              LDA A  RNDM+2    GET RESULT
0887 84 F8              AND A  #$F8      FIX FOR 8 BYTES
0889 D6 92              LDA B  RNDM+1
088B C4 1F              AND B  #$1F      LIMIT TO 8K
088D 9B 41              ADD A  LBLBEG+1  ADD ON BEGINNING
088F D9 40              ADC B  LBLBEG    ADDRESS OF TABLE
0891 97 6A              STA A  XTEMP+1
0893 D7 69              STA B  XTEMP     SET EFFECTIVE ADDRESS
0895 D1 42              CMP B  LBLEND
0897 22 E9              BHI    MIX2
0899 25 04              BCS    MIX3
089B 91 43              CMP A  LBLEND+1
089D 22 E3              BHI    MIX2      SEE IF IN RANGE
089F DE 69     MIX3     LDX    XTEMP     GET THE ADDRESS
08A1 39                 RTS              DONE
                *
                ** PUTLBL
                * ENTER LABEL IN SYMBOL TABLE
08A2 8D C3     PUTLBL   BSR    HASH      GO HASH IT
08A4 A6 00     CHKFRE   LDA A  0,X       GET SYMBOL ENTRY
08A6 27 13              BEQ    PUTIT     IF FREE, TAKE IT
08A8 BD 08 DE           JSR    CHKLBL    GO SEE IF SAME
08AB 27 0B              BEQ    HERROR    IF SO, MULTIPLE OCCURENCE
08AD BD 08 7F           JSR    REHASH    GO REHASH ON COLLISION
08B0 96 A4              LDA A  HASHCT    GET COUNTER
08B2 81 28              CMP A  #40       IF 40 COLLISIONS, FULL
08B4 26 EE              BNE    CHKFRE    GO SEE IF FREE
08B6 86 00              LDA A  #0        SET ERROR 0
08B8 7E 07 E5  HERROR   JMP    ASMERR    GO REPORT ERROR
08BB 96 4F     PUTIT    LDA A  LABEL     GET CHAR
08BD A7 00              STA A  0,X       PUT IN TABLE
08BF 96 50              LDA A  LABEL+1
08C1 A7 01              STA A  1,X
08C3 96 51              LDA A  LABEL+2
08C5 A7 02              STA A  2,X
08C7 96 52              LDA A  LABEL+3
08C9 A7 03              STA A  3,X
08CB 96 53              LDA A  LABEL+4
08CD A7 04              STA A  4,X
08CF 96 54              LDA A  LABEL+5
08D1 A7 05              STA A  5,X
08D3 96 4B              LDA A  PC
08D5 A7 06              STA A  6,X       STORE PC (HI)
08D7 96 4C              LDA A  PC+1
08D9 A7 07              STA A  7,X       STORE PC (LO)
08DB DF 75              STX    LTEMP     SAVE LABEL ADDRESS
08DD 39                 RTS              DONE
                *
                ** CHKLBL
```

```
LOCN B1 B2 B3
                    * SEE IF LABELS MATCH
08DE 86 02          CHKLBL  LDA A  #2        SET ERROR
08E0 E6 00                  LDA B  0,X
08E2 D4 60                  AND B  LBLMSK
08E4 D1 4F                  CMP B  LABEL
08E6 26 1C                  BNE    CKDONE    IF NO, WERE OK
08E8 D6 50                  LDA B  LABEL+1
08EA E1 01                  CMP B  1,X
08EC 26 16                  BNE    CKDONE
08EE D6 51                  LDA B  LABEL+2
08F0 E1 02                  CMP B  2,X
08F2 26 10                  BNE    CKDONE
08F4 D6 52                  LDA B  LABEL+3
08F6 E1 03                  CMP B  3,X
08F8 26 0A                  BNE    CKDONE
08FA D6 53                  LDA B  LABEL+4
08FC E1 04                  CMP B  4,X
08FE 26 04                  BNE    CKDONE
0900 D6 54                  LDA B  LABEL+5
0902 E1 05                  CMP B  5,X
0904 39             CKDONE  RTS              DONE
                    *
                    ** FNDLBL
                    * FIND A LABEL IN SYMBOL TABLE
0905 BD 08 67       FNDLBL  JSR    HASH      GO HASH IT UP
0908 A6 00          FND10   LDA A  0,X       GET ENTRY
090A 27 0E                  BEQ    FERROR    IF EMPTY, NO FIND
090C BD 08 DE               JSR    CHKLBL    GO SEE IF MATCH
090F 27 0C                  BEQ    GOTLBL    IF SO, WE GOT IT
0911 BD 08 7F               JSR    REHASH    GO MIX EM UP AGAIN
0914 96 A4                  LDA A  HASHCT    GET COUNTER
0916 81 28                  CMP A  #40       IF DO 40 TIMES, NO GOOD
0918 26 EE                  BNE    FND10     RECYCLE
091A 86 FF          FERROR  LDA A  #$FF      SET ERROR
091C 39                     RTS
091D 4F             GOTLBL  CLR A  SET FLAG
091E 39                     RTS
                    *
                    ** FNDOPT
                    * FIND OPERATOR (TYPE) AND EXECUTE
091F 4F             FNDOPT  CLR A
0920 97 5A                  STA A  DATFLG
0922 97 57                  STA A  MATFLG
0924 97 5B                  STA A  FCCFLG
0926 97 5C                  STA A  EJFLG    CLEAR FLAGS
0928 DE 96                  LDX    OPNPTR   GET POINTER
092A DF 6B                  STX    XTEMP1   SET UP
092C DE 94                  LDX    OPTPTR     GET POINTER
092E A6 02                  LDA A  2,X        GET CHAR
0930 97 7D                  STA A  TEMP       SAVE 3RD CHAR
0932 E6 01                  LDA B  1,X        GET 2ND CHAR
0934 A6 00                  LDA A  0,X        GET 1ST CHAR
0936 CE 09 6B               LDX    #OPTABL    POINT TO TABLE
0939 A1 00          CHK1    CMP A  0,X        CHECK FOR MATCH
093B 27 15                  BEQ    MATCH1     IF SO, GO SEE NEXT
```

```
LOCN B1 B2 B3
093D 7D 00 57          TST     MATFLG     CHECK FLAG
0940 26 0B             BNE     OPTERR     IF SET, NO FIND
0942 08          NOMATL INX
0943 08                 INX
0944 08                 INX
0945 08                 INX
0946 08                 INX
0947 08                 INX
0948 8C 0B 75           CPX     #OPTEND+6  CHECK END TABLE
094B 26 EC              BNE     CHK1       IF NOT, CHECK NEXT
094D 86 03       OPTERR LDA A   #3         SET ERROR NO.
094F 7E 07 D6           JMP     OPSERR     GO REPORT
0952 97 57       MATCH1 STA A   MATFLG     SET FLAG
0954 E1 01              CMP B   1,X        CHECK 2ND MATCH
0956 26 EA              BNE     NOMATL     IF NOT, RESTART
0958 36                 PSH A              SAVE CHAR
0959 96 7D              LDA A   TEMP       GET 3RD
095B A1 02              CMP A   2,X        CHECK MATCH
095D 27 03              BEQ     BINGO      IF SO, GOT IT
095F 32                 PUL A              GET 1ST AGAIN
0960 20 E0              BRA     NOMATL
0962 32          BINGO  PUL A              FIX STACK
0963 A6 03              LDA A   3,X        GET OPCODE BASE
0965 97 7E              STA A   OPCODE     SAVE
0967 EE 04              LDX     4,X        GET TYPE ADDRESS
0969 6E 00              JMP     0,X        GO SERVICE TYPE
                 *
                 * THIS IS THE MNEMONIC RECOGNITION AND
                 * BASE OPCODE TABLE
096B 41          OPTABL FCC     'ABA'
096C 42
096D 41
096E 1B                 FCB     $1B
096F 0D 03              FDB     TYPE1
0971 41                 FCC     'ADC'
0972 44
0973 43
0974 89                 FCB     $89
0975 0D 51              FDB     TYPE5
0977 41                 FCC     'ADD'
0978 44
0979 44
097A 8B                 FCB     $8B
097B 0D 51              FDB     TYPE5
097D 41                 FCC     'AND'
097E 4E
097F 44
0980 84                 FCB     $84
0981 0D 51              FDB     TYPE5
0983 41                 FCC     'ASL'
0984 53
0985 4C
0986 48                 FCB     $48
0987 0D 7B              FDB     TYPE6
0989 41                 FCC     'ASR'
```

```
LOCN B1 B2 B3
098A 53
098B 52
098C 47                 FCB     $47
098D 0D 7B              FDB     TYPE6
098F 42                 FCC     'BCC'
0990 43
0991 43
0992 24                 FCB     $24
0993 0D 06              FDB     TYPE2
0995 42                 FCC     'BCS'
0996 43
0997 53
0998 25                 FCB     $25
0999 0D 06              FDB     TYPE2
099B 42                 FCC     'BEQ'
099C 45
099D 51
099E 27                 FCB     $27
099F 0D 06              FDB     TYPE2
09A1 42                 FCC     'BGE'
09A2 47
09A3 45
09A4 2C                 FCB     $2C
09A5 0D 06              FDB     TYPE2
09A7 42                 FCC     'BGT'
09A8 47
09A9 54
09AA 2E                 FCB     $2E
09AB 0D 06              FDB     TYPE2
09AD 42                 FCC     'BHI'
09AE 48
09AF 49
09B0 22                 FCB     $22
09B1 0D 06              FDB     TYPE2
09B3 42                 FCC     'BHS'
09B4 48
09B5 53
09B6 24                 FCB     $24
09B7 0D 06              FDB     TYPE2
09B9 42                 FCC     'BIT'
09BA 49
09BB 54
09BC 85                 FCB     $85
09BD 0D 51              FDB     TYPE5
09BF 42                 FCC     'BLE'
09C0 4C
09C1 45
09C2 2F                 FCB     $2F
09C3 0D 06              FDB     TYPE2
09C5 42                 FCC     'BLO'
09C6 4C
09C7 4F
09C8 25                 FCB     $25
09C9 0D 06              FDB     TYPE2
09CB 42                 FCC     'BLS'
```

```
LOCN B1 B2 B3
09CC 4C
09CD 53
09CE 23                 FCB     $23
09CF 0D 06              FDB     TYPE2
09D1 42                 FCC     'BLT'
09D2 4C
09D3 54
09D4 2D                 FCB     $2D
09D5 0D 06              FDB     TYPE2
09D7 42                 FCC     'BMI'
09D8 4D
09D9 49
09DA 2B                 FCB     $2B
09DB 0D 06              FDB     TYPE2
09DD 42                 FCC     'BNE'
09DE 4E
09DF 45
09E0 26                 FCB     $26
09E1 0D 06              FDB     TYPE2
09E3 42                 FCC     'BPL'
09E4 50
09E5 4C
09E6 2A                 FCB     $2A
09E7 0D 06              FDB     TYPE2
09E9 42                 FCC     'BRA'
09EA 52
09EB 41
09EC 20                 FCB     $20
09ED 0D 06              FDB     TYPE2
09EF 42                 FCC     'BSR'
09F0 53
09F1 52
09F2 8D                 FCB     $8D
09F3 0D 06              FDB     TYPE2
09F5 42                 FCC     'BVC'
09F6 56
09F7 43
09F8 28                 FCB     $28
09F9 0D 06              FDB     TYPE2
09FB 42                 FCC     'BVS'
09FC 56
09FD 53
09FE 29                 FCB     $29
09FF 0D 06              FDB     TYPE2
0A01 43                 FCC     'CBA'
0A02 42
0A03 41
0A04 11                 FCB     $11
0A05 0D 03              FDB     TYPE1
0A07 43                 FCC     'CLC'
0A08 4C
0A09 43
0A0A 0C                 FCB     $0C
0A0B 0D 03              FDB     TYPE1
0A0D 43                 FCC     'CLI'
```

```
LOCN B1 B2 B3
0A0E 4C
0A0F 49
0A10 0E                 FCB     $0E
0A11 0D 03              FDB     TYPE1
0A13 43                 FCC     'CLR'
0A14 4C
0A15 52
0A16 4F                 FCB     $4F
0A17 0D 7B              FDB     TYPE6
0A19 43                 FCC     'CLV'
0A1A 4C
0A1B 56
0A1C 0A                 FCB     $0A
0A1D 0D 03              FDB     TYPE1
0A1F 43                 FCC     'CMP'
0A20 4D
0A21 50
0A22 81                 FCB     $81
0A23 0D 51              FDB     TYPE5
0A25 43                 FCC     'COM'
0A26 4F
0A27 4D
0A28 43                 FCB     $43
0A29 0D 7B              FDB     TYPE6
0A2B 43                 FCC     'CPX'
0A2C 50
0A2D 58
0A2E 8C                 FCB     $8C
0A2F 0D 51              FDB     TYPE5
0A31 44                 FCC     'DAA'
0A32 41
0A33 41
0A34 19                 FCB     $19
0A35 0D 03              FDB     TYPE1
0A37 44                 FCC     'DEC'
0A38 45
0A39 43
0A3A 4A                 FCB     $4A
0A3B 0D 7B              FDB     TYPE6
0A3D 44                 FCC     'DES'
0A3E 45
0A3F 53
0A40 34                 FCB     $34
0A41 0D 03              FDB     TYPE1
0A43 44                 FCC     'DEX'
0A44 45
0A45 58
0A46 09                 FCB     $09
0A47 0D 03              FDB     TYPE1
0A49 45                 FCC     'END'
0A4A 4E
0A4B 44
0A4C 00                 FCB     00
0A4D 10 DD              FDB     TYPE16
0A4F 45                 FCC     'EOR'
```

```
LOCN B1 B2 B3
0A50 4F
0A51 52
0A52 88                    FCB     $88
0A53 0D 51                 FDB     TYPE5
0A55 45                    FCC     'EQU'
0A56 51
0A57 55
0A58 00                    FCB     0
0A59 10 B0                 FDB     TYPE15
0A5B 46                    FCC     'FCB'
0A5C 43
0A5D 42
0A5E 00                    FCB     0
0A5F 0F 42                 FDB     TYPE9
0A61 46                    FCC     'FCC'
0A62 43
0A63 43
0A64 00                    FCB     0
0A65 0E 87                 FDB     TYPE8
0A67 46                    FCC     'FDB'
0A68 44
0A69 42
0A6A 00                    FCB     0
0A6B 0F 7E                 FDB     TYPE10
0A6D 49                    FCC     'INC'
0A6E 4E
0A6F 43
0A70 4C                    FCB     $4C
0A71 0D 7B                 FDB     TYPE6
0A73 49                    FCC     'INS'
0A74 4E
0A75 53
0A76 31                    FCB     $31
0A77 0D 03                 FDB     TYPE1
0A79 49                    FCC     'INX'
0A7A 4E
0A7B 58
0A7C 08                    FCB     $08
0A7D 0D 03                 FDB     TYPE1
0A7F 4A                    FCC     'JMP'
0A80 4D
0A81 50
0A82 6E                    FCB     $6E
0A83 0D 35                 FDB     TYPE3
0A85 4A                    FCC     'JSR'
0A86 53
0A87 52
0A88 AD                    FCB     $AD
0A89 0D 35                 FDB     TYPE3
0A8B 4C                    FCC     'LDA'
0A8C 44
0A8D 41
0A8E 86                    FCB     $86
0A8F 0D 51                 FDB     TYPE5
0A91 4C                    FCC     'LDS'
```

```
LOCN B1 B2 B3
0A92 44
0A93 53
0A94 8E                 FCB     $8E
0A95 0D 51              FDB     TYPE5
0A97 4C                 FCC     'LDX'
0A98 44
0A99 58
0A9A CE                 FCB     $CE
0A9B 0D 51              FDB     TYPE5
0A9D 4C                 FCC     'LSR'
0A9E 53
0A9F 52
0AA0 44                 FCB     $44
0AA1 0D 7B              FDB     TYPE6
0AA3 4D                 FCC     'MON'
0AA4 4F
0AA5 4E
0AA6 00                 FCB     0
0AA7 10 DD              FDB     TYPE16
0AA9 4E                 FCC     'NAM'
0AAA 41
0AAB 4D
0AAC 00                 FCB     0
0AAD 10 E9              FDB     TYPE17
0AAF 4E                 FCC     'NEG'
0AB0 45
0AB1 47
0AB2 40                 FCB     $40
0AB3 0D 7B              FDB     TYPE6
0AB5 4E                 FCC     'NOP'
0AB6 4F
0AB7 50
0AB8 01                 FCB     01
0AB9 0D 03              FDB     TYPE1
0ABB 4F                 FCC     'OPT'
0ABC 50
0ABD 54
0ABE 00                 FCB     0
0ABF 0F ED              FDB     TYPE12
0AC1 4F                 FCC     'ORA'
0AC2 52
0AC3 41
0AC4 8A                 FCB     $8A
0AC5 0D 51              FDB     TYPE5
0AC7 4F                 FCC     'ORG'
0AC8 52
0AC9 47
0ACA 00                 FCB     0
0ACB 10 A2              FDB     TYPE14
0ACD 50                 FCC     'PAG'
0ACE 41
0ACF 47
0AD0 00                 FCB     0
0AD1 10 89              FDB     TYPE13
0AD3 50                 FCC     'PSH'
```

```
LOCN B1 B2 B3
0AD4 53
0AD5 48
0AD6 36                    FCB     $36
0AD7 0D 88                 FDB     TYPE7
0AD9 50                    FCC     'PUL'
0ADA 55
0ADB 4C
0ADC 32                    FCB     $32
0ADD 0D 88                 FDB     TYPE7
0ADF 52                    FCC     'RMB'
0AE0 4D
0AE1 42
0AE2 00                    FCB     0
0AE3 11 1F                 FDB     TYPE18
0AE5 52                    FCC     'ROL'
0AE6 4F
0AE7 4C
0AE8 49                    FCB     $49
0AE9 0D 7B                 FDB     TYPE6
0AEB 52                    FCC     'ROR'
0AEC 4F
0AED 52
0AEE 46                    FCB     $46
0AEF 0D 7B                 FDB     TYPE6
0AF1 52                    FCC     'RTI'
0AF2 54
0AF3 49
0AF4 3B                    FCB     $3B
0AF5 0D 03                 FDB     TYPE1
0AF7 52                    FCC     'RTS'
0AF8 54
0AF9 53
0AFA 39                    FCB     $39
0AFB 0D 03                 FDB     TYPE1
0AFD 53                    FCC     'SBA'
0AFE 42
0AFF 41
0B00 10                    FCB     $10
0B01 0D 03                 FDB     TYPE1
0B03 53                    FCC     'SBC'
0B04 42
0B05 43
0B06 82                    FCB     $82
0B07 0D 51                 FDB     TYPE5
0B09 53                    FCC     'SEC'
0B0A 45
0B0B 43
0B0C 0D                    FCB     $0D
0B0D 0D 03                 FDB     TYPE1
0B0F 53                    FCC     'SEI'
0B10 45
0B11 49
0B12 0F                    FCB     $0F
0B13 0D 03                 FDB     TYPE1
0B15 53                    FCC     'SEV'
```

```
LOCN B1 B2 B3
0B16 45
0B17 56
0B18 0B                 FCB     $0B
0B19 0D 03              FDB     TYPE1
0B1B 53                 FCC     'SPC'
0B1C 50
0B1D 43
0B1E 00                 FCB     0
0B1F 0F BD              FDB     TYPE11
0B21 53                 FCC     'STA'
0B22 54
0B23 41
0B24 97                 FCB     $97
0B25 0D 54              FDB     TYPE4
0B27 53                 FCC     'STS'
0B28 54
0B29 53
0B2A 9F                 FCB     $9F
0B2B 0D 54              FDB     TYPE4
0B2D 53                 FCC     'STX'
0B2E 54
0B2F 58
0B30 DF                 FCB     $DF
0B31 0D 54              FDB     TYPE4
0B33 53                 FCC     'SUB'
0B34 55
0B35 42
0B36 80                 FCB     $80
0B37 0D 51              FDB     TYPE5
0B39 53                 FCC     'SWI'
0B3A 57
0B3B 49
0B3C 3F                 FCB     $3F
0B3D 0D 03              FDB     TYPE1
0B3F 54                 FCC     'TAB'
0B40 41
0B41 42
0B42 16                 FCB     $16
0B43 0D 03              FDB     TYPE1
0B45 54                 FCC     'TAP'
0B46 41
0B47 50
0B48 06                 FCB     $06
0B49 0D 03              FDB     TYPE1
0B4B 54                 FCC     'TBA'
0B4C 42
0B4D 41
0B4E 17                 FCB     $17
0B4F 0D 03              FDB     TYPE1
0B51 54                 FCC     'TPA'
0B52 50
0B53 41
0B54 07                 FCB     $07
0B55 0D 03              FDB     TYPE1
0B57 54                 FCC     'TST'
```

```
LOCN B1 B2 B3
0B58 53
0B59 54
0B5A 4D                    FCB     $4D
0B5B 0D 7B                 FDB     TYPE6
0B5D 54                    FCC     'TSX'
0B5E 53
0B5F 58
0B60 30                    FCB     $30
0B61 0D 03                 FDB     TYPE1
0B63 54                    FCC     'TTL'
0B64 54
0B65 4C
0B66 00                    FCB     0
0B67 10 E9                 FDB     TYPE17
0B69 54                    FCC     'TXS'
0B6A 58
0B6B 53
0B6C 35                    FCB     $35
0B6D 0D 03                 FDB     TYPE1
0B6F 57              OPTEND FCC     'WAI'
0B70 41
0B71 49
0B72 3E                    FCB     $3E
0B73 0D 03                 FDB     TYPE1
                     ** PARSE
                     * PARSE A LINE OF SOURCE INTO POINTERS
                     * AND CHECK SYNTAX
0B75 96 48           PARSE  LDA A   LINBYT
0B77 08              PARS0A INX
0B78 4A                     DEC A
0B79 2A FC                  BPL     PARS0A
0B7B DF 7B                  STX     QTEMP
0B7D DF 8D                  STX     LINPTR    SAVE PRINT POSITION
0B7F 86 FF           PARSE0 LDA A   #$FF
0B81 97 55                  STA A   PRFLG     SET PROCESS FLAG
0B83 97 5E                  STA A   PRTFLG
0B85 97 5F                  STA A   PAGFLG
0B87 BD 0C 65               JSR     CLRLAB    GO CLEAR LABEL STORE
0B8A 4F                     CLR A
0B8B 97 90                  STA A   OPCNT     SET OP COUNT =0
0B8D 97 AB                  STA A   MODFY     SET FLAG
0B8F 97 7D                  STA A   TEMP
0B91 97 59                  STA A   PCFLAG
0B93 97 81                  STA A   P2ERR1
0B95 97 82                  STA A   P2ERR2
0B97 97 83                  STA A   P2ERR3
0B99 97 56                  STA A   ERRFLG
0B9B DF 94                  STX     OPTPTR
0B9D DF 96                  STX     OPNPTR
0B9F DE 7B                  LDX     QTEMP
0BA1 A6 00                  LDA A   0,X       GET FIRST CHAR
0BA3 81 0D                  CMP A   #$D       CHECK FOR EMPTY
0BA5 26 03                  BNE     CHKCOM
0BA7 7E 0C 2D               JMP     PARSE3
0BAA 81 2A           CHKCOM CMP A   #'*       CHECK FOR COMMEMT
```

```
LOCN B1 B2 B3
0BAC 27 78          BEQ    FINDCR
0BAE 81 20    PARSE1 CMP A  #'          CHECK FOR NO LABEL
0BB0 27 22          BEQ    PARSE2
0BB2 97 59          STA A  PCFLAG
0BB4 81 41          CMP A  #'A          CHECK FOR LETTER A
0BB6 25 04          BCS    LABERR
0BB8 81 5A          CMP A  #'Z          CHECK FOR Z
0BBA 23 07          BLS    PARS1A
0BBC 86 04    LABERR LDA A  #4          SET ERROR
0BBE BD 07 E5       JSR    ASMERR
0BC1 20 0E          BRA    PARS1B       FINISH LINE
0BC3 BD 0C 8F PARS1A JSR   COPLBL       GO COPY THE LABEL
0BC6 4D             TST A
0BC7 26 08          BNE    PARS1B
0BC9 C1 0D          CMP B  #$D          CHECK FOR CR
0BCB 27 60          BEQ    PARSE3
0BCD C1 20          CMP B  #'
0BCF 26 EB          BNE    LABERR
0BD1 BD 0C 50 PARS1B JSR   FINDS2       GO FIND A SPACE
0BD4 BD 0C 5C PARSE2 JSR   NXTBL2       GO GET NEXT TOKEN
0BD7 27 54          BEQ    PARSE3       IF Z, NO OPERATION
0BD9 5F             CLR B
0BDA D7 55          STA B  PRFLG        SET PROCESS FLAG
0BDC 86 FF          LDA A  #$FF
0BDE 97 59          STA A  PCFLAG
0BE0 DF 94          STX    OPTPTR       SAVE OPERATION POINTER
0BE2 08             INX
0BE3 A6 00          LDA A  0,X
0BE5 81 0D          CMP A  #$D
0BE7 27 16          BEQ    PARS2F
0BE9 08             INX
0BEA A6 00          LDA A  0,X
0BEC 81 0D          CMP A  #$D
0BEE 27 0F          BEQ    PARS2F
0BF0 20 12          BRA    PARS2A
0BF2 96 8F    PEVAL LDA A  PASS
0BF4 4A             DEC A
0BF5 97 56          STA A  ERRFLG
0BF7 BD 11 D5       JSR    EVAL         GO EVALUATE
0BFA 7F 00 56       CLR    ERRFLG
0BFD 39             RTS                 RETURN
0BFE 02             NOP                 SPACE
0BFF 86 03    PARS2F LDA A  #$03
0C01 20 48          BRA    PARFF2
0C03 02             NOP                 SPACE
0C04 8D 55    PARS2A BSR    NXTBLK
0C06 27 25          BEQ    PARSE3
0C08 81 41          CMP A  #'A          IS IT AN A?
0C0A 27 05          BEQ    PARS2D
0C0C 81 42          CMP A  #'B          IS IT A B?
0C0E 26 14          BNE    PARS2E
0C10 5C       PARS2B INC B
0C11 5C       PARS2D INC B
0C12 08             INX
0C13 A6 00          LDA A  0,X          GET CHAR
```

```
LOCN B1 B2 B3
0C15 81 0D            CMP A  #$D
0C17 27 20            BEQ    PARSE4
0C19 81 20            CMP A  #'       IS IT A SPACE?
0C1B 27 1F            BEQ    PARS2H
0C1D 09       PARS2J  DEX
0C1E 20 04            BRA    PARS2E
0C20                  RMB    4
0C24 DF 96    PARS2E  STX    OPNPTR
0C26 08       FINDCR  INX           BUMP POINTER
0C27 A6 00            LDA A  0,X     GET CHAR
0C29 81 0D            CMP A  #$D     IS IT A CR
0C2B 26 F9            BNE    FINDCR  IF NOT, GET NEXT
0C2D 96 7D    PARSE3  LDA A  TEMP
0C2F 27 07            BEQ    PARSE5
0C31 DF 7B            STX    QTEMP
0C33 BD 07 D6 PARSE7  JSR    OPSERR
0C36 DE 7B    PARSE6  LDX    QTEMP
0C38 39       PARSE5  RTS
0C39 D7 AB    PARSE4  STA B  MODFY
0C3B 39               RTS             DONE
0C3C D7 AB    PARS2H  STA B  MODFY     SAVE
0C3E 8D 1C            BSR    NXTBL2   GET NEXT
0C40 27 EB            BEQ    PARSE3
0C42 20 E0            BRA    PARS2E
0C44 DE 4B    FND222  LDX    PC       GET PC
0C46 DF 6D            STX    XTEMP2   SAVE IT
0C48 7E 09 1F         JMP    FNDOPT
0C4B 97 7D    PARFF2  STA A  TEMP
0C4D 20 D7            BRA    FINDCR   GO LOCATE CR
0C4F 08       FINDSP  INX           BUMP POINTER
0C50 A6 00    FINDS2  LDA A  0,X     GET THE CHAR
0C52 81 0D            CMP A  #$D     CHECK FOR CR
0C54 27 0E            BEQ    NXTBL3
0C56 81 20            CMP A  #'      IS IT A SPACE?
0C58 26 F5            BNE    FINDSP  IF NOT, GET NEXT
0C5A 39               RTS             DONE
0C5B 08       NXTBLK  INX           BUMP POINTER
0C5C A6 00    NXTBL2  LDA A  0,X     GET CHAR
0C5E 81 20            CMP A  #'      IS IT A SPACE?
0C60 27 F9            BEQ    NXTBLK  IF SO, GET NEXT
0C62 81 0D            CMP A  #$D     IS IT A CR
0C64 39       NXTBL3  RTS             DONE

                      *
                      ** CLRLAB
                      * CLEAR LABEL STORAGE
0C65 CE 00 20 CLRLAB  LDX    #$0020
0C68 DF 4F            STX    LABEL
0C6A CE 20 20         LDX    #$2020
0C6D DF 51            STX    LABEL+2
0C6F DF 53            STX    LABEL+4  SET EM
0C71 39               RTS
                      *
                      *
```

```
LOCN B1 B2 B3
                    *
                    ** ADDPCN
                    * INCREMENT PC N TIMES
                    * SET OPERAND (BYTE) COUNT
0C72 DE 4B      ADDPC3  LDX     PC          GET THE PC
0C74 08                 INX
0C75 08                 INX                 BUMP TWICE
0C76 7C 00 90           INC     OPCNT
0C79 7C 00 90           INC     OPCNT       KICK OPERAND COUNT
0C7C 20 0A              BRA     ADDPC0
0C7E DE 4B      ADDPC2  LDX     PC          GET THE PC
0C80 08                 INX                 BUMP IT
0C81 7C 00 90           INC     OPCNT
0C84 20 02              BRA     ADDPC0
0C86 DE 4B      ADDPC1  LDX     PC
0C88 08         ADDPC0  INX                 BUMP IT
0C89 DF 4B              STX     PC          PUT BACK
0C8B 7C 00 90           INC     OPCNT
0C8E 39                 RTS                 DONE
                    *
                    ** COPLBL
                    * COPY LABEL TO LABEL STORE
0C8F 8D 1B      COPLBL  BSR     GETCHR
0C91 97 4F              STA A   LABEL
0C93 8D 17              BSR     GETCHR
0C95 97 50              STA A   LABEL+1
0C97 8D 13              BSR     GETCHR
0C99 97 51              STA A   LABEL+2
0C9B 8D 0F              BSR     GETCHR
0C9D 97 52              STA A   LABEL+3
0C9F 8D 0B              BSR     GETCHR
0CA1 97 53              STA A   LABEL+4
0CA3 8D 07              BSR     GETCHR
0CA5 97 54              STA A   LABEL+5
0CA7 39                 RTS                 RETURN
0CA8 08         COPDON  INX
0CA9 39                 RTS
                    *
0CAA                    RMB     2
                    *
                    *
                    ** GETCHR
                    * GET A CHARACTER
0CAC A6 00      GETCHR  LDA A   0,X
0CAE 84 7F              AND A   #$7F        MASK  PARITY
0CB0 16                 TAB
0CB1 81 30              CMP A   #'0
0CB3 25 0C              BCS     FIX         IF <0, FIX STACK
0CB5 81 39              CMP A   #'9
0CB7 23 EF              BLS     COPDON      IF <=9, OK
0CB9 81 41              CMP A   #'A
0CBB 25 04              BCS     FIX         IF <A, FIX STACK
0CBD 81 5A              CMP A   #'Z
0CBF 23 E7              BLS     COPDON      IF <=Z, OK
0CC1 31         FIX     INS
```

```
LOCN B1 B2 B3
0CC2 31              INS          FIX STACK
0CC3 4F              CLR A        SET A
0CC4 39              RTS          DONE
                     *
                     ** OUT3S
                     * PRINT 3 SPACES
0CC5 8D 02      OUT3S  BSR   OUTSZ
0CC7 8D 00      OUT2S  BSR   OUTSZ
0CC9 7E 03 1E   OUTSZ  JMP   OUTS    PRINT A SPACE
                     *
                     ** OUTHXS
                     * PRINT 2 HEX DIGITS AND A SPACE
0CCC 8D 02      OUTHXS BSR   OUTHEX  GO PRINT DIGITS
0CCE 20 F9           BRA    OUTSZ
                     *
                     ** OUTHEX
                     * PRINT A AS 2 HEX DIGITS
0CD0 36         OUTHEX PSH A        SAVE
0CD1 8D 08           BSR    HEXL    GO CONVERT
0CD3 8D 03           BSR    PRTIT   GO PRINT IT
0CD5 32              PUL A
0CD6 8D 07           BSR    HEXR    GO CONVERT
0CD8 7E 03 20   PRTIT  JMP   OUTCH   GO PRINT
                     *
0CDB 44         HEXL   LSR A
0CDC 44              LSR A
0CDD 44              LSR A
0CDE 44              LSR A
                     *
0CDF 84 0F      HEXR   AND A  #$F     MASK DOWN
0CE1 8B 90           ADD A  #$90
0CE3 19              DAA
0CE4 89 40           ADC A  #$40
0CE6 19              DAA
0CE7 39              RTS            TRICK CONVERT
                     *
                     ** SUB16
                     * 16 BIT SUBTRACT
0CE8 97 7D      SUB16  STA A  TEMP    SAVE
0CEA A6 01           LDA A  1,X
0CEC 10              SBA
0CED A7 01           STA A  1,X
0CEF A6 00           LDA A  0,X
0CF1 92 7D           SBC A  TEMP
0CF3 A7 00           STA A  0,X
0CF5 49              ROL A
0CF6 88 01           EOR A  #1
0CF8 46              ROR A          SET ARITH CARRY
0CF9 39              RTS
                     *
                     ** ADD16
                     * 16 BIT ADD
0CFA EB 01      ADD16  ADD B  1,X     ADD ON
0CFC A9 00           ADC A  0,X      ADD WITH CARRY (MS)
0CFE A7 00           STA A  0,X      SAVE
```

```
LOCN B1 B2 B3
0D00 E7 01          STA B  1,X       SAVE LS
0D02 39             RTS
                    *
                    ** TYPE1
                    * HANDLES TYPE1 INSTRUCTIONS
0D03 7E 0C 86  TYPE1   JMP    ADDPC1    GO FIX PC
                    *
                    ** TYPE2
                    * HANDLES TYPE2 INSTRUCTIONS
0D06 96 AB     TYPE2   LDA A  MODFY     CHECK MODIFY FLAG
0D08 26 42             BNE    TYP3R
0D0A BD 0C 7E          JSR    ADDPC2
0D0D 96 8F             LDA A  PASS      CHECK PASS COUNT
0D0F 27 23             BEQ    TYPE2D    IF PASS 1, SKIP
0D11 BD 11 D5          JSR    EVAL      GO EVALUATE OPERAND
0D14 26 16             BNE    TYPE2B    IF EVAL ERROR, UNDEFINED
0D16 96 4B             LDA A  PC
0D18 D6 4C             LDA B  PC+1      REFERENCE ADDRESS
0D1A CE 00 7B          LDX    #QTEMP    POINT
0D1D BD 0C E8          JSR    SUB16     GO SUBTRACT
0D20 4F                CLR A
0D21 D6 7C             LDA B  QTEMP+1   GET LS RESULT
0D23 D7 7F             STA B  OP1       SAVE BRANCH AMOUNT
0D25 2A 01             BPL    TYPE2A    IF POS, SKIP
0D27 43                COM A            COMPLEMENT A
0D28 91 7B     TYPE2A  CMP A  QTEMP     CHECK SIGN EXTENSION
0D2A 27 08             BEQ    TYPE2D    IF EQUAL, OK
0D2C 7F 00 7F  TYPE2B  CLR    OP1       SET BRANCH = 0
0D2F 86 06             LDA A  #6
0D31 7E 07 E5          JMP    ASMERR    GO REPORT ERROR
0D34 39        TYPE2D  RTS              DONE
                    *
                    ** TYPE3
                    * HANDLES TYPE3 INST.
0D35 96 AB     TYPE3   LDA A  MODFY     GET MODIFIER
0D37 26 13             BNE    TYP3R     IF SET, ERROR
0D39 BD 0D A3  TYPE3A  JSR    INDEX     GO CHECK INDEXED
                    *
                    ** EXTEND
                    * CHECKS FOR EXTENDED ADDRESSING (DEFAULT)
0D3C 96 8F     EXTEND  LDA A  PASS
0D3E 27 09             BEQ    EXTEN1    CHECK PASS=1
0D40 BD 11 D5          JSR    EVAL      GO EVALUATE OPERAND
0D43 DE 7B     EXTENO  LDX    QTEMP     GET RESULT
0D45 DF 7F             STX    OP1       SET BYTES 2,3
0D47 8D 13             BSR    FIXMOD
0D49 7E 0C 72  EXTEN1  JMP    ADDPC3    KICK PC AGAIN
0D4C 86 03     TYP3R   LDA A  #3
0D4E 7E 07 D6          JMP    OPSERR
                    *
                    ** TYPE5
                    * HANDLE TYPE5 INST.
0D51 BD 0E 3F  TYPE5   JSR    IMMED     CHECK IMMEDIATE
                    *
                    ** TYPE4
```

```
LOCN B1 B2 B3
                    * HANDLE TYPE4 INST.
0D54 BD 0E 04  TYPE4   JSR     DIRECT    GO CHECK DIRECT
0D57 20 E0             BRA     TYPE3A    DEFAULT EXTEND
                    *
                    ** FIXMOD
                    * SET UP MODIFIER
0D59 8D 01     TFIXMD  BSR     FIXMOD
0D5B 39                RTS
0D5C D6 7E     FIXMOD  LDA B   OPCODE
0D5E C1 80             CMP B   #$80
0D60 24 05             BCC     FIXM3     CHECK NO MODIFIER
0D62 96 AB     FIXM4   LDA A   MODFY
0D64 26 36             BNE     TYPE7C    CHECK ILLEGAL
0D66 39                RTS
0D67 C4 0F     FIXM3   AND B   #$F
0D69 C1 0B             CMP B   #$B       CHECK NO MODIFIER
0D6B 22 F5             BHI     FIXM4
0D6D 96 AB     FIXM5   LDA A   MODFY      GET MODIFIER
0D6F 27 2B             BEQ     TYPE7C
0D71 4A                DEC A
0D72 40                NEG A
0D73 84 40             AND A   #$40
0D75 9B 7E             ADD A   OPCODE
0D77 97 7E             STA A   OPCODE    FIX UP OPCODE
0D79 4F                CLR A             RESET ERROR
0D7A 39                RTS
                    *
                    ** TYPE6
                    * HANDLE TYPE6 INST.
0D7B 96 AB     TYPE6   LDA A   MODFY      GET MODIFIER
0D7D 4A                DEC A
0D7E 2A 0D             BPL     TYPE7A    CHECK INHERENT (A,B)
0D80 D6 7E             LDA B   OPCODE    GET OPCODE
0D82 CB 20             ADD B   #$20      ADD ON
0D84 D7 7E             STA B   OPCODE    PUT BACK
0D86 20 B1             BRA     TYPE3A    GO DO TYPE3
                    *
                    ** TYPE7
                    * HANDLE TYPE7 INSTRUCTIONS
0D88 96 AB     TYPE7   LDA A   MODFY      GET MODIFIER
0D8A 4A                DEC A
0D8B 2B BF,            BMI     TYP3R
0D8D D6 7E     TYPE7A  LDA B   OPCODE     GET CODE
0D8F C1 3F             CMP B   #$3F      CHECK PUSH OR PULL
0D91 23 03             BLS     TYPE7D
0D93 40                NEG A
0D94 84 10             AND A   #$10      MASK DOWN
0D96 1B        TYPE7D  ABA               MODIFY
0D97 97 7E             STA A   OPCODE    SAVE
0D99 7E 0C 86          JMP     ADDPC1    KICK PC
0D9C 31        TYPE7C  INS
0D9D 31                INS
0D9E 86 03             LDA A   #3
0DA0 7E 07 D6          JMP     OPSERR
                    *
```

```
LOCN B1 B2 B3
                    ** INDEX
                    * CHECK FOR INDEX ADDRESSING
                    * RETURN IF NOT
0DA3 DE 6B          INDEX   LDX     XTEMP1      GET OPERAND PTR
0DA5 7F 00 7F               CLR     OP1
0DA8 A6 00                  LDA A   0,X         FIRST CHAR
0DAA 81 58                  CMP A   #'X         IS IT AN X?
0DAC 26 0C                  BNE     INDEX1      IF NOT, CHECK NEXT
0DAE A6 01                  LDA A   1,X
0DB0 81 20                  CMP A   #'
0DB2 27 22                  BEQ     INDEX3
0DB4 81 0D                  CMP A   #$D
0DB6 26 02                  BNE     INDEX1
0DB8 20 1C                  BRA     INDEX3
0DBA A6 00          INDEX1  LDA A   0,X         GET CHAR
0DBC 81 2C                  CMP A   #',         CHECK FOR COMMA
0DBE 27 20                  BEQ     INDEX4
0DC0 81 20                  CMP A   #'          CHECK FOR SPACE
0DC2 27 2F                  BEQ     INDEX0      IF SO, EXTENDED
0DC4 81 0D                  CMP A   #$D
0DC6 27 2B                  BEQ     INDEX0
0DC8 08                     INX
0DC9 20 EF                  BRA     INDEX1
0DCB 96 8F          INDEX2  LDA A   PASS
0DCD 27 07                  BEQ     INDEX3      CHECK PASS COUNT
0DCF BD 11 D5               JSR     EVAL        GO EVALUATE
0DD2 96 7C                  LDA A   QTEMP+1
0DD4 97 7F                  STA A   OP1         SET OFFSET
0DD6 BD 0D 59       INDEX3  JSR     TFIXMD
0DD9 26 26                  BNE     FIXXX2
0DDB 31                     INS
0DDC 31                     INS                 FIX STAC
0DDD 7E 0C 7E               JMP     ADDPC2
0DE0 A6 01          INDEX4  LDA A   1,X         GET NEXT CHAR
0DE2 81 58                  CMP A   #'X         IS IT X
0DE4 26 14                  BNE     INDEX5      IF NOT, EXTENDED
0DE6 08                     INX
0DE7 A6 01          INDE00  LDA A   1,X         GET FOLLOWING
0DE9 81 20                  CMP A   #'          MUST BE SPACE
0DEB 27 DE                  BEQ     INDEX2      IF SO, INDEXED
0DED 81 0D                  CMP A   #$D
0DEF 27 DA                  BEQ     INDEX2
0DF1 20 07                  BRA     INDEX5
0DF3 D6 7E          INDEX0  LDA B   OPCODE
0DF5 CB 10                  ADD B   #$10
0DF7 D7 7E                  STA B   OPCODE
0DF9 39             INDEX9  RTS
0DFA 86 08          INDEX5  LDA A   #8
0DFC 31                     INS
0DFD 31                     INS
0DFE 7E 07 D6               JMP     OPSERR      GO REPORT ERROR
0E01 31             FIXXX2  INS
0E02 31                     INS                 FIX STACK
0E03 39                     RTS                 DONE
                    *
```

```
LOCN B1 B2 B3
                    ** DIRECT
                    * CHECK FOR DIRECT ADDRESSING
0E04 DE 6B          DIRECT  LDX     XTEMP1
0E06 86 FF                  LDA A   #$FF
0E08 97 56                  STA A   ERRFLG      DISABLE ERRORS
0E0A 97 60                  STA A   LBLMSK      SET MASK
0E0C DF 73                  STX     XTEMP5      SAVE POINTER
0E0E BD 11 D5               JSR     EVAL        GO CALCULATE
0E11 7F 00 56               CLR     ERRFLG      ENABLE ERRORS
0E14 C6 7F                  LDA B   #$7F
0E16 D7 60                  STA B   LBLMSK      RESET MASK
0E18 DE 6B                  LDX     XTEMP1      GET END PTR
0E1A E6 00                  LDA B   0,X         GET TERMINATOR
0E1C C1 2C                  CMP B   #',         CHECK  INDEXED
0E1E 36                     PSH A
0E1F 07                     TPA
0E20 DE 73                  LDX     XTEMP5
0E22 DF 6B                  STX     XTEMP1
0E24 33                     PUL B
0E25 06                     TAP                 RESET CCR
0E26 27 10                  BEQ     NDIR
0E28 5D                     TST B
0E29 26 0D                  BNE     NDIR        IF NO FIND ALL, NO DIRECT
0E2B D6 7B                  LDA B   QTEMP       GET MS BYTE
0E2D 26 09                  BNE     NDIR
0E2F BD 0D 59               JSR     TFIXMD
0E32 26 50                  BNE     FIXXX
0E34 96 7C                  LDA A   QTEMP+1
0E36 20 2F                  BRA     IMMED2
0E38 D6 7E          NDIR    LDA B   OPCODE
0E3A CB 10                  ADD B   #$10
0E3C D7 7E                  STA B   OPCODE
0E3E 39                     RTS                 PASS ON
                    *
                    ** IMMED
                    * CHECK FOR IMMEDIATE ADDRESSING
0E3F DE 6B          IMMED   LDX     XTEMP1      GET OPERAND PTR
0E41 A6 00                  LDA A   0,X
0E43 81 23                  CMP A   #'#         CHECK FOR #
0E45 27 07                  BEQ     IMMED1      IF SO, IMMEDIATE
0E47 D6 7E          IMMED0  LDA B   OPCODE
0E49 CB 10                  ADD B   #$10
0E4B D7 7E                  STA B   OPCODE
0E4D 39                     RTS
0E4E 08             IMMED1  INX
0E4F DF 6B                  STX     XTEMP1      MOVE PAST #
0E51 D6 7E                  LDA B   OPCODE
0E53 C4 0F                  AND B   #$F
0E55 C1 0B                  CMP B   #$B
0E57 22 15                  BHI     IMMED3
0E59 BD 0D 59               JSR     TFIXMD
0E5C 26 26                  BNE     FIXXX
0E5E 96 8F                  LDA A   PASS
0E60 27 07                  BEQ     IMMED4      IF PASS1, SKIP
0E62 BD 11 D5               JSR     EVAL        GO EVALUATE OPERAND
```

```
LOCN B1 B2 B3
0E65 96 7C          LDA A  QTEMP+1   GET LS RESULT
0E67 97 7F    IMMED2 STA A  OP1      SET BYTE 2
0E69 BD 0C 7E IMMED4 JSR    ADDPC2
0E6C 20 16           BRA    FIXXX
0E6E 96 AB    IMMED3 LDA A  MODFY
0E70 4A              DEC A
0E71 2B 03           BMI    IMMED5
0E73 7E 0D 9C IMMED6 JMP    TYPE7C
0E76 BD 0C 72 IMMED5 JSR    ADDPC3
0E79 96 8F           LDA A  PASS
0E7B 27 07           BEQ    FIXXX    CHECK PASS COUNT
0E7D BD 11 D5        JSR    EVAL     GO EVALUATE
0E80 DE 7B           LDX    QTEMP    GET ARG
0E82 DF 7F           STX    OP1      SET OPERANDS
0E84 31       FIXXX  INS
0E85 31              INS
0E86 39              RTS
                     *
                     ** TYPE8
                     *
0E87 86 FF    TYPE8  LDA A  #$FF
0E89 97 56           STA A  ERRFLG   SUPPRESS ERROR REPORT
0E8B DE 96           LDX    OPNPTR
0E8D DF 73           STX    XTEMP5   SAVE START
0E8F BD 11 D5        JSR    EVAL     GO EVALUATE EXPR
0E92 CE 02 00        LDX    #BYTSTK
0E95 DF 87           STX    BYTPTR   SET UP POINTER
0E97 96 7C           LDA A  QTEMP+1  GET RESULT
0E99 27 56           BEQ    TYPE8F   IF ZERO, DELIM TYPE
0E9B DE 6B           LDX    XTEMP1
0E9D A6 00           LDA A  0,X
0E9F 81 2C           CMP A  #',
0EA1 26 4E           BNE    TYPE8F   IF NOT COMMA, DELIM TYPE
0EA3 08              INX              MOVE PAST ,
0EA4 96 7C           LDA A  QTEMP+1   GET DATA
0EA6 E6 00           LDA B  0,X       GET NEXT CHAR
0EA8 08              INX
0EA9 C1 0D           CMP B  #$D       CHECK FOR CR
0EAB 26 04           BNE    TYPE8A
0EAD 97 5B           STA A  FCCFLG
0EAF C6 20           LDA B  #$20      GET SPACE
0EB1 D7 7E    TYPE8A STA B  OPCODE    STORE FIRST BYTE
0EB3 DF 71           STX    XTEMP4    SAVE PTR
0EB5 BD 0C 86        JSR    ADDPC1    KICK PC
0EB8 DE 71           LDX    XTEMP4    GET PTR BACK
0EBA 4A              DEC A            SEE IF DONE
0EBB 26 01           BNE    TYPE8B
0EBD 39              RTS
0EBE 97 5A    TYPE8B STA A  DATFLG    SET FLAG
0EC0 86 01           LDA A  #1
0EC2 97 A6           STA A  BYTCNT    SAVE BYTE COUNT
0EC4 E6 00    TYPE8E LDA B  0,X       GET CHAR
0EC6 08              INX              KICK PTR
0EC7 DF 71           STX    XTEMP4    SAVE
0EC9 7D 00 5B        TST    FCCFLG    CHECK FLAG
```

```
LOCN B1 B2 B3
0ECC 26 06          BNE    TYPE8D
0ECE C1 0D          CMP B  #$D        CHECK CR
0ED0 26 04          BNE    TYPE8C
0ED2 97 5B          STA A  FCCFLG
0ED4 C6 20    TYPE8D LDA B  #$20
0ED6 DE 87    TYPE8C LDX    BYTPTR     GET STACK PTR
0ED8 E7 00          STA B  0,X        PUT ON STACK
0EDA 08             INX
0EDB DF 87          STX    BYTPTR     SAVE NEXT POSITION
0EDD BD 0C 86       JSR    ADDPC1
0EE0 DE 71          LDX    XTEMP4     RETRIEVE PTR
0EE2 7A 00 5A       DEC    DATFLG     COUNT OFF
0EE5 26 DD          BNE    TYPE8E     LOOP TILL DONE
0EE7 86 01          LDA A  #1
0EE9 97 90          STA A  OPCNT    CORRECT OP COUNT
0EEB 97 5A          STA A  DATFLG     SET FLAG
0EED 7F 00 56       CLR    ERRFLG     CLEAR ERROR SUPPRESS
0EF0 39             RTS               DONE
                    *
0EF1 DE 73    TYPE8F LDX    XTEMP5  GET START POINTER
0EF3 E6 00          LDA B  0,X        GET DELIMITER
0EF5 08             INX               MOVE PAST
0EF6 A6 00          LDA A  0,X        GET CHAR
0EF8 97 7E          STA A  OPCODE     PUT AWAY
0EFA DF 71          STX    XTEMP4
0EFC BD 0C 86       JSR    ADDPC1     KICK PC
0EFF DE 71          LDX    XTEMP4
0F01 E1 01          CMP B  1,X        CHECK END
0F03 26 01          BNE    TYPE8G
0F05 39             RTS
0F06 D7 5A    TYPE8G STA B  DATFLG     SET FLAG
0F08 86 01          LDA A  #1
0F0A 97 A6          STA A  BYTCNT     SET COUNT
0F0C 08             INX               MOVE POINTER
0F0D A6 00    TYPE8H LDA A  0,X        GET CHAR
0F0F 08             INX
0F10 DF 71          STX    XTEMP4     SAVE PTR
0F12 DE 87          LDX    BYTPTR     GET STACK PTR
0F14 11             CBA               CHECK END
0F15 27 15          BEQ    TYPE8I     IF SO, QUIT
0F17 81 0D          CMP A  #$D        CHECK FOR CR
0F19 27 11          BEQ    TYPE8I     IF SO, QUIT
0F1B A7 00          STA A  0,X        PUT ON STACK
0F1D 08             INX
0F1E DF 87          STX    BYTPTR     SAVE NEW POSITION
0F20 8C 03 00       CPX    #BYTSTK+256
0F23 27 13          BEQ    TYPE8J
0F25 BD 0C 86       JSR    ADDPC1
0F28 DE 71          LDX    XTEMP4     GET SOURCE PTR BACK
0F2A 20 E1          BRA    TYPE8H     LOOP TILL DONE
0F2C 7F 00 56 TYPE8I CLR   ERRFLG     RESET ERROR SUPPRESSION
0F2F 86 01          LDA A  #1
0F31 97 90          STA A  OPCNT      SET COUNT
0F33 39             RTS               DONE
                    *
```

```
LOCN B1 B2 B3
0F34 8D 63      TYPE8K  BSR     TYP10C
0F36 20 02              BRA     TYPE8L
0F38 8D F2      TYPE8J  BSR     TYPE8I
0F3A 7F 00 56   TYPE8L  CLR     ERRFLG      RESET FLAG
0F3D 86 0B              LDA A   #11         SET ERROR
0F3F 7E 07 E5           JMP     ASMERR
                *
                *
                ** TYPE9
                * HANDLES TYPE 9 INSTRUCTIONS
0F42 CE 02 00   TYPE9   LDX     #BYTSTK
0F45 DF 87              STX     BYTPTR      SET UP STACK
0F47 BD 0B F2           JSR     PEVAL       GO EVALUATE
0F4A 96 7C              LDA A   QTEMP+1     GET DATA
0F4C 97 7E              STA A   OPCODE      PUT AWAY
0F4E BD 0C 86   TYPE9C  JSR     ADDPC1      KICK PC
0F51 DE 6B              LDX     XTEMP1      GET SOURCE PTR
0F53 A6 00              LDA A   0,X
0F55 81 0D              CMP A   #$D         CHECK DONE
0F57 27 04              BEQ     TYPE9D
0F59 81 2C              CMP A   #',
0F5B 27 05              BEQ     TYPE9A
0F5D 86 01      TYPE9D  LDA A   #1
0F5F 97 90              STA A   OPCNT    CORRECT COUNT
0F61 39                 RTS
0F62 97 5A      TYPE9A  STA A   DATFLG     SET
0F64 86 01              LDA A   #1
0F66 97 A6              STA A   BYTCNT     SET COUNT
0F68 08         TYPE9B  INX                MOVE TO NEXT ARGUMENT
0F69 DF 6B              STX     XTEMP1     SAVE PTR
0F6B BD 0B F2           JSR     PEVAL      GO CRUNCH
0F6E DE 87              LDX     BYTPTR     GET STACK
0F70 96 7C              LDA A   QTEMP+1    GET DATA
0F72 A7 00              STA A   0,X        SAVE IT
0F74 08                 INX
0F75 DF 87              STX     BYTPTR     UPDATE AND SAVE
0F77 8C 03 00           CPX     #BYTSTK+256
0F7A 27 BC              BEQ     TYPE8J
0F7C 20 D0              BRA     TYPE9C
                *
                *
                ** TYPE10
                * EVALUATE TYPE 10 INSTRUCTION
0F7E CE 02 00   TYPE10  LDX     #BYTSTK
0F81 DF 87              STX     BYTPTR     SET UP STACK
0F83 BD 0B F2           JSR     PEVAL      GO EVALUATE
0F86 DE 7B              LDX     QTEMP
0F88 DF 7E              STX     OPCODE     PUT DATA
0F8A BD 0C 7E   TYP10A  JSR     ADDPC2     KICK PC
0F8D DE 6B              LDX     XTEMP1     GET TERM PTR
0F8F A6 00              LDA A   0,X        GET TERM
0F91 81 0D              CMP A   #$D        CHECK CR
0F93 27 04              BEQ     TYP10C
0F95 81 2C              CMP A   #',
0F97 27 05              BEQ     TYP10B
```

```
LOCN B1 B2 B3
0F99 86 02      TYP10C  LDA A  #2
0F9B 97 90              STA A  OPCNT    CORRECT COUNT
0F9D 39                 RTS
0F9E 97 5A      TYP10B  STA A  DATFLG    SET MULT DATA FLAG
0FA0 86 02              LDA A  #2
0FA2 97 A6              STA A  BYTCNT    SET COUNT
0FA4 08                 INX             MOVE PAST TERM
0FA5 DF 6B              STX    XTEMP1    SET NEW INDEX
0FA7 BD 0B F2           JSR    PEVAL     GO EVALUATE NEXT
0FAA DE 87              LDX    BYTPTR    GET POINTER
0FAC 96 7B              LDA A  QTEMP
0FAE A7 00              STA A  0,X
0FB0 96 7C              LDA A  QTEMP+1
0FB2 A7 01              STA A  1,X
0FB4 08                 INX
0FB5 08                 INX             PUT DATA AND ADJUST
0FB6 DF 87              STX    BYTPTR    SAVE PTR
0FB8 8C 03 00           CPX    #BYTSTK+256
0FBB 20 CD              BRA    TYP10A    LOOP TILL DONE
                *
0FBD 7F 00 59   TYPE11  CLR    PCFLAG    TURN PC OFF
0FC0 96 8F              LDA A  PASS
0FC2 27 25              BEQ    TYP11C    IF PASS 1 IGNORE
0FC4 96 5D              LDA A  P3FLG
0FC6 27 21              BEQ    TYP11C
0FC8 96 4F              LDA A  LABEL
0FCA 26 1E              BNE    TYPERR
0FCC 96 AE              LDA A  LIST      SEE IF LIST ON
0FCE 27 19              BEQ    TYP11C    IF NOT, IGNORE
0FD0 BD 11 D5           JSR    EVAL      CRUNCH IT
0FD3 D6 7C              LDA B  QTEMP+1   GET COUNT
0FD5 26 02              BNE    TYP11A
0FD7 C6 01              LDA B  #1        SET 1 LINE
0FD9 BD 07 BA   TYP11A  JSR    PCRLF     DO LF
0FDC 96 5C              LDA A  EJFLG     SEE IF EJECTED
0FDE 26 03              BNE    TYP11B    IF SO, QUIT
0FE0 5A                 DEC B            COUNT OFF
0FE1 26 F6              BNE    TYP11A    LOOP TILL DONE
0FE3 7F 00 5C   TYP11B  CLR    EJFLG     RESET FLAG
0FE6 7F 00 5E           CLR    PRTFLG    DON'T PRINT
0FE9 39         TYP11C  RTS              DONE
                *
0FEA 7E 10 B4   TYPERR  JMP    TYP15A
                *
0FED 7F 00 59   TYPE12  CLR    PCFLAG
0FF0 96 8F              LDA A  PASS
0FF2 26 F5              BNE    TYP11C
0FF4 96 4F              LDA A  LABEL
0FF6 26 F2              BNE    TYPERR
0FF8 DE 6B      TYP12D  LDX    XTEMP1    GET ARG POINTER
0FFA A6 02              LDA A  2,X
0FFC 97 7D              STA A  TEMP      SAVE
0FFE A6 00              LDA A  0,X
1000 E6 01              LDA B  1,X       GET SWITCH ID
1002 CE 10 41           LDX    #OPTLST   POINT TO LIST
```

```
LOCN B1 B2 B3
1005 A1 00      TYP12A  CMP A  0,X        SEE IF MATCH
1007 27 10              BEQ    TYP12B
1009 08         TYP12C  INX
100A 08                 INX
100B 08                 INX
100C 08                 INX
100D 08                 INX
100E 08                 INX              ADVANCE PTR
100F 8C 10 89           CPX    #OPNEND+6 SEE IF TABLE END
1012 26 F1              BNE    TYP12A    LOOP
1014 86 0A              LDA A  #10
1016 7E 07 E5           JMP    ASMERR    SET ERROR NUMBER AND REPORT
1019 E1 01      TYP12B  CMP B  1,X        SEE IF SECOND MATCH
101B 26 EC              BNE    TYP12C    IF NOT, GO BACK
101D 36                 PSH A
101E 96 7D              LDA A  TEMP      GET 3RD CHAR
1020 A1 02              CMP A  2,X       SEE IF MATCH
1022 32                 PUL A
1023 26 E4              BNE    TYP12C    IF NOT, LOOP
1025 A6 03              LDA A  3,X       GET DATA
1027 EE 04              LDX    4,X       GET ADDRESS
1029 A7 00              STA A  0,X       SET SWITCH
102B DE 6B              LDX    XTEMP1
102D A6 00      FNDEND  LDA A  0,X
102F 08                 INX
1030 DF 6B              STX    XTEMP1
1032 81 0D              CMP A  #$D
1034 27 0A              BEQ    OPTDON
1036 81 20              CMP A  #' '
1038 27 06              BEQ    OPTDON
103A 81 2C              CMP A  #','
103C 27 BA              BEQ    TYP12D
103E 20 ED              BRA    FNDEND
1040 39         OPTDON  RTS              DONE
                *
1041 4C         OPTLST  FCC    'LIS'
1042 49
1043 53
1044 FF                 FCB    $FF
1045 00 AE              FDB    LIST
1047 4E                 FCC    'NOL'
1048 4F
1049 4C
104A 00                 FCB    0
104B 00 AE              FDB    LIST
104D 54                 FCC    'TAP'
104E 41
104F 50
1050 FF                 FCB    $FF
1051 00 B2              FDB    TAPE
1053 4E                 FCC    'NOT'
1054 4F
1055 54
1056 00                 FCB    0
1057 00 B2              FDB    TAPE
```

```
LOCN B1 B2 B3
1059 4D                    FCC     'MEM'
105A 45
105B 4D
105C FF                    FCB     $FF
105D 00 B3                 FDB     MEMORY
105F 4E                    FCC     'NOM'
1060 4F
1061 4D
1062 00                    FCB     0
1063 00 B3                 FDB     MEMORY
1065 53                    FCC     'SYM'
1066 59
1067 4D
1068 FF                    FCB     $FF
1069 00 AF                 FDB     SYMBOL
106B 4E                    FCC     'NOS'
106C 4F
106D 53
106E 00                    FCB     0
106F 00 AF                 FDB     SYMBOL
1071 47                    FCC     'GEN'
1072 45
1073 4E
1074 FF                    FCB     $FF
1075 00 B0                 FDB     GENER
1077 4E                    FCC     'NOG'
1078 4F
1079 47
107A 00                    FCB     0
107B 00 B0                 FDB     GENER
107D 50                    FCC     'PAG'
107E 41
107F 47
1080 FF                    FCB     $FF
1081 00 B1                 FDB     PAGER
1083 4E           OPNEND   FCC     'NOP'
1084 4F
1085 50
1086 00                    FCB     0
1087 00 B1                 FDB     PAGER
                  *
                  *
1089 7F 00 59     TYPE13   CLR     PCFLAG
108C 96 8F                 LDA A   PASS
108E 27 11                 BEQ     TYP13A
1090 96 4F                 LDA A   LABEL
1092 26 20                 BNE     TYP15A
1094 97 5E                 STA A   PRTFLG
1096 96 B1                 LDA A   PAGER      SEE IF PAGER ON
1098 27 07                 BEQ     TYP13A     IF NOT, IGNORE
109A 96 AE                 LDA A   LIST       SEE IF LIST ON
109C 27 03                 BEQ     TYP13A     IF NOT, IGNORE
109E 7F 00 5F              CLR     PAGFLG
10A1 39           TYP13A   RTS
                  *
```

```
LOCN B1 B2 B3
10A2 96 4F      TYPE14  LDA A   LABEL
10A4 26 0E              BNE     TYP15A
10A6 BD 11 D5           JSR     EVAL        GO EVALUATE OPERAND
10A9 DE 7B              LDX     QTEMP       GET RESULT
10AB DF 4B              STX     PC          SET PC
10AD DF 6D              STX     XTEMP2
10AF 39                 RTS
                *
10B0 96 4F      TYPE15  LDA A   LABEL
10B2 26 05              BNE     EQU1
10B4 86 07      TYP15A  LDA A   #7           SET ERROR
10B6 7E 07 E5           JMP     ASMERR
10B9 BD 09 05   EQU1    JSR     FNDLBL      FIND LABEL
10BC DF FD              STX     $FD
10BE 96 8F              LDA A   PASS        CHECK PASS
10C0 4A                 DEC A
10C1 97 56              STA A   ERRFLG
10C3 BD 11 D5           JSR     EVAL        GO EVALUATE
10C6 7F 00 56           CLR     ERRFLG
10C9 DE FD              LDX     $FD
10CB 96 7C              LDA A   QTEMP+1
10CD D6 7B              LDA B   QTEMP
10CF E7 06              STA B   6,X
10D1 A7 07              STA A   7,X
10D3 DE 7B              LDX     QTEMP
10D5 DF 6D              STX     XTEMP2
10D7 39         TYP15C  RTS
10D8 96 84              LDA A   LSTERR      ELSE ERROR
10DA 7E 07 E5           JMP     ASMERR      GO REPORT
                *
10DD 7F 00 59   TYPE16  CLR     PCFLAG
10E0 96 4F              LDA A   LABEL
10E2 26 D0              BNE     TYP15A
10E4 86 FF              LDA A   #$FF
10E6 97 58              STA A   ENDFLG
10E8 39                 RTS
                *
10E9 7F 00 59   TYPE17  CLR     PCFLAG
10EC 96 8F              LDA A   PASS
10EE 27 2E              BEQ     NAM3        IF PASS1 IGNORE
10F0 96 4F              LDA A   LABEL
10F2 26 C0              BNE     TYP15A
10F4 CE 00 C6           LDX     #TITLE
10F7 DF 65              STX     XSAVE       SAVE PTR
10F9 DE 96      NAM1    LDX     OPNPTR      GET POINTER
10FB A6 00              LDA A   0,X
10FD 81 0D              CMP A   #$D         CHECK FOR CR
10FF 27 0F              BEQ     NAM2
1101 08                 INX     GET TO NEXT
1102 DF 96              STX     OPNPTR
1104 DE 65              LDX     XSAVE       GET OTHER PTR
1106 A7 00              STA A   0,X
1108 08                 INX
1109 DF 65              STX     XSAVE       UPDATE
110B 8C 00 E6           CPX     #TITLE+32
```

```
LOCN B1 B2 B3
110E 26 E9             BNE     NAM1
1110 86 20    NAM2     LDA A   #$20
1112 DE 65             LDX     XSAVE
1114 8C 00 E6 FILTIT   CPX     #TITLE+32
1117 27 05             BEQ     NAM3
1119 A7 00             STA A   0,X
111B 08                INX
111C 20 F6             BRA     FILTIT
111E 39       NAM3     RTS
              *
111F BD 11 D5 TYPE18   JSR     EVAL
1122 CE 00 7B          LDX     #QTEMP
1125 D6 4C             LDA B   PC+1
1127 96 4B             LDA A   PC
1129 BD 0C FA          JSR     ADD16
112C DE 7B             LDX     QTEMP
112E DF 4B             STX     PC
1130 39                RTS
              *
              ** EJECT
1131 37       EJECT    PSH B
1132 D6 B1             LDA B   PAGER      SEE IF PAGE ON
1134 27 65             BEQ     NOEJT      IF NOT, SKIP
1136 CE 11 D1          LDX     #EJSTR     POINT TO EJECT STRING
1139 BD 07 AB          JSR     PDATA      PRINT THE CHARS
113C 37                PSH B
113D 4F                CLR A
113E 97 A8             STA A   LINCNT
1140 97 B1             STA A   PAGER      TURN PAGER OFF
1142 C6 03             LDA B   #3
1144 27 06             BEQ     MARDON
1146 BD 07 BA PRTMAR   JSR     PCRLF
1149 5A                DEC B
114A 26 FA             BNE     PRTMAR     PRINT MARGIN
114C CE 00 C6 MARDON   LDX     #TITLE
114F BD 07 AB          JSR     PDATA      SET IN TITLE
1152 CE 11 A9          LDX     #PPP
1155 BD 07 AB          JSR     PDATA      PRINT HEADER
1158 96 AD             LDA A   PAGENO+1
115A 8B 01             ADD A   #1         KICK PAGE COUNT
115C 19                DAA
115D 97 AD             STA A   PAGENO+1
115F 96 AC             LDA A   PAGENO
1161 89 00             ADC A   #0
1163 19                DAA
1164 97 AC             STA A   PAGENO
1166 27 0C             BEQ     PPAG2
1168 84 F0             AND A   #$F0
116A 27 03             BEQ     PPAG6
116C 8D 2F             BSR     OUTHL      PRINT MS
116E 5C                INC B              SET FLAG
116F 96 AC    PPAG6    LDA A   PAGENO     GET BYTE
1171 8D 30             BSR     OUTHR      PRINT LS OF MS
1173 5C                INC B
1174 96 AD    PPAG2    LDA A   PAGENO+1   GET LS BYTE
```

```
LOCN B1 B2 B3
1176 27 1E            BEQ     PPAG3
1178 5D               TST B             SEE IF PRINTED YET
1179 26 04            BNE     PPAG5     IF SO, JUST PRINT
117B 85 F0            BIT A   #$F0      CHECK MS DIGIT
117D 27 04            BEQ     PPAG4     IF 0, DON'T PRINT
117F 8D 1C      PPAG5 BSR     OUTHL     PRINT
1181 96 AD            LDA A   PAGENO+1
1183 8D 1E      PPAG4 BSR     OUTHR
1185 BD 07 BA         JSR     PCRLF
1188 BD 07 BA         JSR     PCRLF
118B 86 FF            LDA A   #$FF
118D 97 5C            STA A   EJFLG
118F 97 5F            STA A   PAGFLG
1191 33               PUL B             GET PAGE STATUS
1192 D7 B1            STA B   PAGER     RESTORE
1194 33               PUL B
1195 39               RTS               DONE
1196 5D         PPAG3 TST B             CHECK IF PRINTED
1197 26 E6            BNE     PPAG5
1199 20 E8            BRA     PPAG4
119B 33         NOEJT PUL B
119C 39               RTS               DONE
119D BD 0C DB   OUTHL JSR     HEXL
11A0 7E 03 20         JMP     OUTCH
11A3 BD 0C DF   OUTHR JSR     HEXR
11A6 7E 03 20         JMP     OUTCH
11A9 20         PPP   FCC     '         '
11AA 20
11AB 20
11AC 20
11AD 20
11AE 20
11AF 20
11B0 20
11B1 54               FCC     'TSC MNEMONIC ASSEMBLER    PAGE '
11B2 53
11B3 43
11B4 20
11B5 4D
11B6 4E
11B7 45
11B8 4D
11B9 4F
11BA 4E
11BB 49
11BC 43
11BD 20
11BE 41
11BF 53
11C0 53
11C1 45
11C2 4D
11C3 42
11C4 4C
11C5 45
```

```
LOCN B1 B2 B3
11C6 52
11C7 20
11C8 20
11C9 20
11CA 20
11CB 50
11CC 41
11CD 47
11CE 45
11CF 20
11D0 04              FCB    4
11D1 00        EJSTR FCB    0,0,$A,4
11D2 00
11D3 0A
11D4 04
                     *
                     ** EVAL
                     * EVALUATE AN OPERAND EXPRESSION
11D5 4F        EVAL  CLR A
11D6 97 7B           STA A  QTEMP
11D8 97 7C           STA A  QTEMP+1
11DA 97 63           STA A  OPN          INITIALIZE
11DC DE 6B           LDX    XTEMP1
11DE DF 96           STX    OPNPTR       SET POINTER
11E0 DE 96     EVAL1A LDX    OPNPTR       GET OPERAND PTR
11E2 A6 00     FINDSC LDA A  0,X          GET CHAR
11E4 08              INX
11E5 5F              CLR B
11E6 81 2B           CMP A  #'+
11E8 27 27           BEQ    F1
11EA 5C              INC B
11EB 81 2D           CMP A  #'-
11ED 27 22           BEQ    F1
11EF 5C              INC B
11F0 81 2A           CMP A  #'*
11F2 26 0A           BNE    FINDS4
11F4 09              DEX
11F5 9C 96           CPX    OPNPTR
11F7 07              TPA
11F8 08              INX
11F9 06              TAP
11FA 27 E6           BEQ    FINDSC
11FC 20 13           BRA    F1
11FE 5C        FINDS4 INC B
11FF 81 2F           CMP A  #'/
1201 27 0E           BEQ    F1
1203 C6 FF     F2    LDA B  #$FF
1205 81 20           CMP A  #' 
1207 27 08           BEQ    F1
1209 81 2C           CMP A  #',
120B 27 04           BEQ    F1
120D 81 0D           CMP A  #$D
120F 26 D1           BNE    FINDSC
1211 D7 64     F1    STA B  TERM         SAVE TERMINATOR
1213 09              DEX                 ADJUST
```

```
LOCN B1 B2 B3
1214 DF 6B          STX    XTEMP1
1216 DE 96     LOAD LDX    OPNPTR     GET POINTER
1218 7F 00 7D       CLR    TEMP
121B A6 00          LDA A  0,X        GET CHARACTER
121D 81 41          CMP A  #'A
121F 25 1F          BCS    LOAD1
1221 81 5A          CMP A  #'Z
1223 22 1B          BHI    LOAD1      CHECK FOR LABEL
1225 DF 79          STX    QTEMP2     SAVE X
1227 BD 0C 65       JSR    CLRLAB     SET LABEL TO ZERO
122A DE 79          LDX    QTEMP2     GET X BACK
122C BD 0C 8F       JSR    COPLBL
122F BD 09 05       JSR    FNDLBL     GO GET VALUE
1232 EE 06          LDX    6,X        GET VALUE
1234 DF 79          STX    QTEMP2     STORE IT
1236 DE 6B          LDX    XTEMP1
1238 4D             TST A              SEE IF FOUND
1239 2A 50          BPL    L5
123B 86 01          LDA A  #1
123D 7E 12 98       JMP    F3
1240 C6 01     LOAD1 LDA B  #1         SET ID
1242 81 24          CMP A  #'$         CHECK FOR BASE TAGS
1244 27 2F          BEQ    L1
1246 5C             INC B
1247 81 25          CMP A  #$25        PERCENT
1249 27 2A          BEQ    L1
124B 5C             INC B
124C 81 40          CMP A  #'@
124E 27 25          BEQ    L1
1250 5C             INC B
1251 81 27          CMP A  #$27        CHECK FOR SINGLE QUOTE
1253 27 20          BEQ    L1
1255 DE 6B          LDX    XTEMP1     GET END POINTER
1257 09             DEX                MOVE TO LAST CHAR
1258 7C 00 7D       INC    TEMP
125B 5A             DEC B
125C A6 00          LDA A  0,X        GET IT
125E 81 4F          CMP A  #'O         CHECK OCTAL
1260 27 16          BEQ    L2
1262 81 51          CMP A  #'Q         CHECK OCTAL
1264 27 12          BEQ    L2
1266 5A             DEC B
1267 81 42          CMP A  #'B         CHECK BINARY
1269 27 0D          BEQ    L2
126B 5A             DEC B
126C 81 48          CMP A  #'H         CHECK HEX
126E 27 08          BEQ    L2
1270 5A             DEC B              SET DECIMAL
1271 D7 7D          STA B  TEMP
1273 20 03          BRA    L2
1275 08        L1   INX                MOVE TO FIRST CHAR OF CONST
1276 DF 96          STX    OPNPTR     SAVE
1278 4F        L2   CLR A
1279 97 79          STA A  QTEMP2
127B 97 7A          STA A  QTEMP2+1
```

```
LOCN B1 B2 B3
127D CE 12 C9          LDX    #BCONV    POINT TO TABLE
1280 58                ASL B
1281 27 04             BEQ    L4
1283 08          L3    INX
1284 5A                DEC B
1285 26 FC             BNE    L3        GET TO ADDRESS
1287 EE 00       L4    LDX    0,X       GET ADDRESS
1289 AD 00             JSR    0,X       COLLECT DATA
128B 96 7D       L5    LDA A  TEMP      CHECK PRE OR POST
128D 27 01             BEQ    L6
128F 08                INX
1290 DF 71       L6    STX    XTEMP4    SAVE
1292 9C 6B             CPX    XTEMP1    SEE IF GOT ALL
1294 27 0B             BEQ    EVAL1B
1296 86 09             LDA A  #9
1298 7F 00 7B    F3    CLR    QTEMP
129B 7F 00 7C          CLR    QTEMP+1   RESET ARG
129E 7E 07 E5          JMP    ASMERR    GO TO ERROR
12A1 96 63       EVAL1B LDA A  OPN       GET OPERATION
12A3 CE 12 C1          LDX    #OPNTBL   POINT TO JUMP TABLE
12A6 48                ASL A
12A7 27 04             BEQ    EVAL3
12A9 08          EVAL2 INX               POINT NEXT
12AA 4A                DEC A
12AB 26 FC             BNE    EVAL2     MOVE TO TARGET
12AD EE 00       EVAL3 LDX    0,X       GET TARGET ADDR.
12AF AD 00             JSR    0,X       DO OPERATION
12B1 DE 6B             LDX    XTEMP1    GET POINTER
12B3 08                INX
12B4 DF 96             STX    OPNPTR    SAVE PLACE
12B6 96 64             LDA A  TERM      GET LAST TERM
12B8 97 63             STA A  OPN       SAVE OPERATION
12BA 2B 03             BMI    EVAL4     IF A TERMINATOR, DONE
12BC 7E 11 E0          JMP    EVAL1A    ELSE PROCESS AGAIN
12BF 4F          EVAL4 CLR A             DONE
12C0 39                RTS
                 *
12C1 12 D3       OPNTBL FDB    OPADD
12C3 12 DD             FDB    OPSUB
12C5 12 E7             FDB    OPMUL
12C7 13 0F             FDB    OPDIV
                 *
12C9 13 5B       BCONV FDB     DECM
12CB 13 9A             FDB    HEX
12CD 13 BA             FDB    BIN
12CF 13 D0             FDB    OCT
12D1 13 E7             FDB    ASC
                 *
12D3 96 79       OPADD LDA A   QTEMP2
12D5 D6 7A             LDA B   QTEMP2+1  GET OPERAND
12D7 CE 00 7B          LDX    #QTEMP     POINT TO ACC.
12DA 7E 0C FA          JMP    ADD16      GO ADD
                 *
12DD 96 79       OPSUB LDA A   QTEMP2
12DF D6 7A             LDA B   QTEMP2+1
```

```
LOCN B1 B2 B3
12E1 CE 00 7B          LDX    #QTEMP
12E4 7E 0C E8          JMP    SUB16
                  *
12E7 CE 00 00  OPMUL   LDX    #0
12EA DF 77             STX    QTEMP3     SET ACCUM.
12EC CE 00 77          LDX    #QTEMP3
12EF C6 10             LDA B  #16        SET COUNT
12F1 A6 03     OPMUL2  LDA A  3,X
12F3 46                ROR A              CHECK BIT
12F4 24 09             BCC    OPMUL3
12F6 37                PSH B
12F7 A6 04             LDA A  4,X
12F9 E6 05             LDA B  5,X         GET OPERANDS
12FB BD 0C FA          JSR    ADD16       ADD IN
12FE 33                PUL B
12FF 64 00     OPMUL3  LSR    0,X
1301 66 01             ROR    1,X
1303 66 02             ROR    2,X
1305 66 03             ROR    3,X
1307 5A                DEC B              COUNT OFF
1308 26 E7             BNE    OPMUL2
130A EE 02             LDX    2,X         GET RESULT
130C DF 7B             STX    QTEMP       SAVE
130E 39                RTS
                  *
130F CE 00 00  OPDIV   LDX    #0
1312 DF 77             STX    QTEMP3      INIT. ACCUM.
1314 DE 79             LDX    QTEMP2
1316 D6 7C             LDA B  QTEMP+1
1318 D7 7A             STA B  QTEMP2+1
131A D6 7B             LDA B  QTEMP
131C D7 79             STA B  QTEMP2
131E DF 7B             STX    QTEMP       MOVE OPERAND
1320 C6 11             LDA B  #17         SET COUNT
1322 CE 00 77          LDX    #QTEMP3     POINT TO ACC.
1325 37        OPDIV1  PSH B
1326 96 7B             LDA A  QTEMP
1328 D6 7C             LDA B  QTEMP+1
132A BD 0C E8          JSR    SUB16
132D 25 08             BCS    OPDIV3
132F 96 7B             LDA A  QTEMP
1331 D6 7C             LDA B  QTEMP+1
1333 BD 0C FA          JSR    ADD16       ADD BACK
1336 0C                CLC
1337 69 03     OPDIV3  ROL    3,X
1339 69 02             ROL    2,X
133B 69 01             ROL    1,X
133D 69 00             ROL    0,X         SHIFT IT
133F 33                PUL B              RETRIEVE COUNT
1340 5A                DEC B              COUNT OFF
1341 26 E2             BNE    OPDIV1      DO AGAIN
1343 EE 02             LDX    2,X         GET RESULT
1345 DF 7B             STX    QTEMP       SAVE
1347 39                RTS                DONE
                  *
```

```
LOCN B1 B2 B3
                    *
1348 E6 00          INDEC   LDA B   0,X         GET A CHAR
134A C0 3A                  SUB B   #$3A        REMOVE BIAS
134C 24 02                  BCC     INDEC2
134E CB 0A                  ADD B   #$A         CORRECT
1350 39             INDEC2  RTS
                    *
1351 96 6D          SPCL    LDA A   XTEMP2
1353 97 79                  STA A   QTEMP2
1355 96 6E                  LDA A   XTEMP2+1
1357 97 7A                  STA A   QTEMP2+1
1359 08                     INX                 ALIGN POINTER
135A 39                     RTS
                    *
135B 8D 2B          DECM    BSR     INITR       GO INITIALIZE
135D A6 00                  LDA A   0,X
135F 81 2A                  CMP A   #'*         CHECK SPECIAL CHAR
1361 27 EE                  BEQ     SPCL
1363 8D E3          DECM2   BSR     INDEC       GO FETCH
1365 24 20                  BCC     DECM3
1367 37                     PSH B
1368 96 79                  LDA A   QTEMP2
136A D6 7A                  LDA B   QTEMP2+1
136C 8D 25                  BSR     LONE        LEFT ONE
136E 8D 23                  BSR     LONE        AGAIN
1370 DB 7A                  ADD B   QTEMP2+1
1372 D7 7A                  STA B   QTEMP2+1    ADD IN
1374 99 79                  ADC A   QTEMP2
1376 97 79                  STA A   QTEMP2
1378 8D 19                  BSR     LONE        LEFT AGAIN
137A 33                     PUL B
137B 4F                     CLR A
137C DB 7A                  ADD B   QTEMP2+1
137E 99 79                  ADC A   QTEMP2
1380 D7 7A                  STA B   QTEMP2+1
1382 97 79                  STA A   QTEMP2
1384 08                     INX
1385 20 DC                  BRA     DECM2       GO AT IT AGAIN
1387 39             DECM3   RTS
                    *
1388 DE 96          INITR   LDX     OPNPTR      GET POINTER
138A 7F 00 79               CLR     QTEMP2
138D 7F 00 7A               CLR     QTEMP2+1    ZERO ACCUMULATOR
1390 39                     RTS
                    *
1391 8D 00          LTWO    BSR     LONE        LEFT ONE
                    *
1393 78 00 7A       LONE    ASL     QTEMP2+1
1396 79 00 79               ROL     QTEMP2
1399 39                     RTS
                    *
139A 8D EC          HEX     BSR     INITR       INITIALIZE
139C A6 00          HEX2    LDA A   0,X         GET CHAR
139E 80 47                  SUB A   #'G         REMOVE BIAS
13A0 2A 17                  BPL     HEX4
```

```
LOCN B1 B2 B3
13A2 8B 06          ADD A  #6        ADD ON
13A4 2A 04          BPL    HEX3
13A6 8B 07          ADD A  #7        ADD AGAIN
13A8 2A 0F          BPL    HEX4      REMOVE $3A - $40
13AA 8B 0A    HEX3  ADD A  #10       CORRECT
13AC 2B 0B          BMI    HEX4      REMOVE <$30
13AE 8D E1          BSR    LTWO
13B0 8D DF          BSR    LTWO
13B2 9B 7A          ADD A  QTEMP2+1
13B4 97 7A          STA A  QTEMP2+1
13B6 08             INX
13B7 20 E3          BRA    HEX2
13B9 39       HEX4  RTS
              *
13BA 8D CC    BIN   BSR    INITR
13BC A6 00    BIN2  LDA A  0,X
13BE 80 30          SUB A  #$30
13C0 2B F7          BMI    HEX4
13C2 81 01          CMP A  #1
13C4 22 F3          BHI    HEX4
13C6 46             ROR A
13C7 79 00 7A       ROL    QTEMP2+1
13CA 79 00 79       ROL    QTEMP2
13CD 08             INX
13CE 20 EC          BRA    BIN2
              *
13D0 8D B6    OCT   BSR    INITR
13D2 A6 00    OCT1  LDA A  0,X
13D4 80 30          SUB A  #$30
13D6 2B E1          BMI    HEX4
13D8 81 07          CMP A  #7
13DA 22 DD          BHI    HEX4
13DC 8D B3          BSR    LTWO
13DE 8D B3          BSR    LONE      MULT X 8
13E0 9B 7A          ADD A  QTEMP2+1
13E2 97 7A          STA A  QTEMP2+1
13E4 08             INX
13E5 20 EB          BRA    OCT1
13E7 8D 9F    ASC   BSR    INITR     GO INITIALIZE
13E9 A6 00          LDA A  0,X       GET CHAR
13EB 97 7A          STA A  QTEMP2+1  SET CHAR
13ED DE 6B          LDX    XTEMP1    IGNORE REST
13EF 39             RTS              DONE
              *
              *
              ** SHELL
              * DO A SHELL SORT
13F0 7F 00 7D SHELL CLR    TEMP
13F3 86 08          LDA A  #8
13F5 36             PSH A
13F6 86 20          LDA A  #32
13F8 36             PSH A
13F9 86 68          LDA A  #104
13FB 36             PSH A            SET GAP WIDTHS
13FC 32       SHELL1 PUL A          GET A GAP
```

```
LOCN B1 B2 B3
13FD 97 AA            STA A  GAP       SAVE
13FF DE 40            LDX    LBLBEG
1401 DF 77      SHELL2 STX   QTEMP3    SAVE PLACE
1403 DF 7B      SETGAP STX   QTEMP     SAVE PTR
1405 96 7C            LDA A  QTEMP+1
1407 9B AA            ADD A  GAP
1409 97 7A            STA A  QTEMP2+1
140B 96 7B            LDA A  QTEMP
140D 89 00            ADC A  #0
140F 97 79            STA A  QTEMP2    SET BOTTOM POINTER
1411 91 42            CMP A  LBLEND
1413 25 08            BCS    SORT
1415 26 60            BNE    PASDON
1417 96 7A            LDA A  QTEMP2+1
1419 91 43            CMP A  LBLEND+1
141B 24 5A            BCC    PASDON
141D C6 06      SORT  LDA B  #6        SET FOR 6 COMPARES
141F DE 7B            LDX    QTEMP     GET TOP PTR
1421 DF 69            STX    XTEMP     SAVE
1423 DE 79            LDX    QTEMP2    GET BOTTOM PTR
1425 DF 6D            STX    XTEMP2    SAVE
1427 DE 69      CHKLOP LDX   XTEMP     GET PTR
1429 A6 00            LDA A  0,X
142B 08               INX              GET CHAR AND ADV.
142C DF 69            STX    XTEMP
142E DE 6D            LDX    XTEMP2    GET PTR
1430 A1 00            CMP A  0,X       CHECK RELATION
1432 27 4D            BEQ    SAME      SAME?
1434 23 30            BLS    ORDOK     IN ORDER?
1436 C6 08            LDA B  #8        SET 8 TRANSFERS
1438 DE 7B            LDX    QTEMP     GET TABLE PTR
143A DF 69      MOVELP STX   XTEMP     SAVE
143C 37               PSH B            SAVE COUNT
143D A6 00            LDA A  0,X
143F DE 79            LDX    QTEMP2    GET DEST PTR
1441 E6 00            LDA B  0,X
1443 A7 00            STA A  0,X       SWITCH
1445 08               INX
1446 DF 79            STX    QTEMP2    SAVE PTR
1448 DE 69            LDX    XTEMP     GET DEST PTR
144A E7 00            STA B  0,X       SWITCH
144C 08               INX
144D 33               PUL B
144E 5A               DEC B
144F 26 E9            BNE    MOVELP    LOOP TILL DONE
1451 96 7D            LDA A  TEMP      GET FLAG
1453 26 03            BNE    SHELL5
1455 73 00 7D         COM    TEMP      CHANGE FLAG
1458 DE 7B      SHELL5 LDX   QTEMP     GET PTR
145A 9C 40            CPX    LBLBEG    SEE IF AT TOP
145C 27 08            BEQ    ORDOK     IF SO, GO DOWN
145E C6 08            LDA B  #8
1460 09         DECXX DEX              MOVE BACK
1461 5A               DEC B
1462 26 FC            BNE    DECXX
```

```
LOCN B1 B2 B3
1464 20 9D              BRA     SETGAP
1466 96 7D      ORDOK   LDA A   TEMP        GET FLAG
1468 27 03              BEQ     SHELL6      IF 0, FOWARD
146A 7F 00 7D           CLR     TEMP        SET FOWARD
146D DE 77      SHELL6  LDX     QTEMP3      GET LIST POINTER
146F C6 08              LDA B   #8          SET FOR NEXT
1471 08         OFFLOP  INX
1472 5A                 DEC B               MOVE PTR
1473 26 FC              BNE     OFFLOP
1475 20 8A              BRA     SHELL2
1477 96 AA      PASDON  LDA A   GAP         GET DISTANCE
1479 81 08              CMP A   #8
147B 27 03              BEQ     SRTDON      IF 8, DONE
147D 7E 13 FC           JMP     SHELL1
1480 39         SRTDON  RTS
1481 08         SAME    INX
1482 DF 6D              STX     XTEMP2      SAVE PTR
1484 5A                 DEC B               CHECKED ALL 6?
1485 26 A0              BNE     CHKLOP
1487 20 DD              BRA     ORDOK
                *
                *
                ** OBJCOD
                * PRODUCE MIKBUG RECORD FORMAT
1489 96 62      OBJCOD  LDA A   OBJINT      SEE IF FIRST CALL
148B 27 0C              BEQ     OBJC01      IF SO, SKIP
148D CE 04 C0           LDX     #TAPEON
1490 BD 04 B2           JSR     CONTRL      TURN TAPE ON
1493 BD 04 C8           JSR     DELAY       DELAY FOR STARTUP
1496 7F 00 62           CLR     OBJINT      RESET FLAG
1499 DE 6D      OBJC01  LDX     XTEMP2      GET PC (LAST TIME'S)
149B 9C 9E              CPX     LASTPC
149D 07                 TPA
149E DE 4B              LDX     PC
14A0 DF 9E              STX     LASTPC      SET NEW LAST PC
14A2 06                 TAP                 RESTORE CCR
14A3 27 03              BEQ     OBJC04      SEE IF NEW ORG
14A5 BD 15 18           JSR     PRTREC      IF SO, PRINT LAST PART
14A8 96 90      OBJC04  LDA A   OPCNT       GET BYTE COUNTER
14AA D6 A7      OBJC03  LDA B   BUFCNT       GET BUFFER COUNT
14AC 26 04              BNE     OBJC05      IF NOT EMPTY, SKIP
14AE DE 6D              LDX     XTEMP2      GET PC
14B0 DF A0              STX     OBJADR      SET RECORD ADDRESS
14B2 DE 89      OBJC05  LDX     OBJPTR      GET DEST PTR
14B4 D6 7E              LDA B   OPCODE
14B6 E7 00              STA B   0,X
14B8 08                 INX
14B9 7C 00 A7           INC     BUFCNT
14BC 4A                 DEC A
14BD 27 13              BEQ     OBJC06
14BF D6 7F              LDA B   OP1
14C1 E7 00              STA B   0,X
14C3 08                 INX
14C4 7C 00 A7           INC     BUFCNT
14C7 4A                 DEC A
```

```
LOCN B1 B2 B3
14C8 27 08           BEQ    OBJC06
14CA D6 80           LDA B  OP2
14CC E7 00           STA B  0,X
14CE 08              INX
14CF 7C 00 A7        INC    BUFCNT     PUT DATA, SET COUNT
14D2 8D 20    OBJC06 BSR    CHKGEN     GO CHECK IF BUF. FULL
14D4 96 5A           LDA A  DATFLG     CHECK FCC,FCB,FDB
14D6 27 3F           BEQ    OBJDON     IF NOT, DONE
14D8 CE 02 00        LDX    #BYTSTK
14DB DF 71           STX    XTEMP4     SET DATA BUFFER POINTER
14DD DE 71    OBJC07 LDX    XTEMP4     GET DATA POINTER
14DF 9C 87           CPX    BYTPTR     SEE IF EMPTY
14E1 27 34           BEQ    OBJDON     IF SO, DONE
14E3 A6 00           LDA A  0,X        GET DATA
14E5 08              INX
14E6 DF 71           STX    XTEMP4     FIX PTR
14E8 DE 89           LDX    OBJPTR     GET PTR
14EA A7 00           STA A  0,X        PUT DATA
14EC 08              INX               ADVANCE
14ED 7C 00 A7        INC    BUFCNT     FIX COUNT
14F0 8D 02           BSR    CHKGEN     CHECK GENERATE TIME
14F2 20 E9           BRA    OBJC07     LOOP TILL EMPTY
14F4 DF 89    CHKGEN STX    OBJPTR     SAVE POINTER
14F6 96 A7           LDA A  BUFCNT     GET COUNT
14F8 81 0F           CMP A  #15
14FA 22 01           BHI    GENOBJ     IF >=16  TIME TO PUNCH
14FC 39              RTS
14FD 36       GENOBJ PSH A              SAVE COUNT
14FE 86 10           LDA A  #16         SET BYTE COUNT
1500 BD 15 1C        JSR    RECORD     GO PUNCH RECORD
1503 32              PUL A              GET COUNT
1504 CE 00 B4        LDX    #OBJBUF
1507 80 10           SUB A  #16        CALCULATE DATA LEFT
1509 97 A7           STA A  BUFCNT     UPDATE COUNT
150B 27 08    SHIFTL BEQ    SAVEPL     IF 0, HAVE PLACE
150D E6 10    MOVE   LDA B  16,X       GET DATA
150F E7 00           STA B  0,X
1511 08              INX               MOVE PTR
1512 4A              DEC A             KICK COUNT
1513 26 F8           BNE    MOVE       MOVE ALL DATA
1515 DF 89    SAVEPL STX    OBJPTR     SAVE BUFFER PTR
1517 39       OBJDON RTS               DONE
1518 96 A7    PRTREC LDA A  BUFCNT     GET  COUNT
151A 27 FB           BEQ    OBJDON     IF 0, NOTHING TO PUNCH
151C 36       RECORD PSH A             SAVE COUNT
151D 7F 00 A7        CLR    BUFCNT     SET COUNT 0
1520 CE 00 B4        LDX    #OBJBUF
1523 DF 89           STX    OBJPTR     RESET POINTER
1525 8D 3D           BSR    HEADER     PUNCH HEADER
1527 32              PUL A
1528 36              PSH A              GET COUNT
1529 8B 03           ADD A  #3         SET BYTE COUNT
152B 8D 23           BSR    TAPBYT     PUNCH BYTE
152D 96 A0           LDA A  OBJADR     GET MS ADDRESS
152F BD 15 50        JSR    TAPBYT
```

```
LOCN B1 B2 B3
1532 96 A1            LDA A  OBJADR+1
1534 8D 1A            BSR    TAPBYT
1536 32               PUL A
1537 36               PSH A             GET COUNT AGAIN
1538 9B A1            ADD A  OBJADR+1
153A 97 A1            STA A  OBJADR+1
153C 96 A0            LDA A  OBJADR
153E 89 00            ADC A  #0
1540 97 A0            STA A  OBJADR     SET NEW ADDRESS
1542 33               PUL B             GET COUNT
1543 DE 89            LDX    OBJPTR
1545 A6 00      OBJLP LDA A  0,X        GET DATA
1547 8D 07            BSR    TAPBYT     PUNCH IT
1549 08               INX
154A 5A               DEC B             CHECK DONE
154B 26 F8            BNE    OBJLP
154D 96 61            LDA A  CKSUM      GET CHECKSUM
154F 43               COM A             CORRECT
                      *
                      ** TAPBYT
                      * PUNCH A BYTE AND CALC CHECKSUM
1550 36         TAPBYT PSH A            SAVE BYTE
1551 9B 61            ADD A  CKSUM      UPDATE CHECKSUM
1553 97 61            STA A  CKSUM
1555 32               PUL A
1556 36               PSH A             GET CHAR
1557 BD 0C DB         JSR    HEXL
155A BD 03 23         JSR    TAPOUT
155D 32               PUL A
155E BD 0C DF         JSR    HEXR
1561 7E 03 23         JMP    TAPOUT
                      *
1564 CE 15 6F   HEADER LDX   #LNHDX
1567 C6 08            LDA B  #8
1569 7F 00 61         CLR    CKSUM      SET CHECKSUM
156C 7E 04 B6         JMP    PCTRL      GO PUNCH
156F 0D         LNHDX  FCB   $D,$A,0,0,0,0
1570 0A
1571 00
1572 00
1573 00
1574 00
1575 53               FCC    'S1'
1576 31
                      *
                      *
                      *
                      *
                      ** MEMCOD
                      * INSTALL OBJECT CODE IN MEMORY
1577 DE 6D      MEMCOD LDX   XTEMP2     GET PC
1579 9C 9C            CPX    LSTPCM     CHECK CONTIGUOUS CODE
157B 07               TPA
157C DE 4B            LDX    PC
157E DF 9C            STX    LSTPCM
```

```
LOCN B1 B2 B3
1580 06                  TAP          RESTORE STATUS
1581 27 20               BEQ    MEM2  IF CONT., SKIP
1583 DE 8B               LDX    MEMPTR GET POINTER
1585 96 6D               LDA A  XTEMP2 GET PC
1587 A7 02               STA A  2,X
1589 96 6E               LDA A  XTEMP2+1
158B A7 03               STA A  3,X    PUT IN MEMORY
158D 9C 49               CPX    MEMOBJ CHECK BEGINNING
158F 27 03               BEQ    MEM1
1591 BD 15 F4            JSR    FIXCNT GO FIX BYTE COUNT
1594 DE 8B      MEM1     LDX    MEMPTR GET POINTER
1596 DF A2               STX    LASTM  SAVE PLACE
1598 08                  INX
1599 08                  INX
159A 08                  INX
159B 08                  INX
159C 4F                  CLR A
159D 97 9A               STA A  MCOUNT
159F 97 9B               STA A  MCOUNT+1 SET BYTE COUNT
15A1 DF 8B               STX    MEMPTR SAVE PTR
15A3 DE 8B      MEM2     LDX    MEMPTR GET POINTER
15A5 D6 90               LDA B  OPCNT  GET COUNT
15A7 96 7E               LDA A  OPCODE
15A9 A7 00               STA A  0,X
15AB 08                  INX
15AC BD 15 E7            JSR    INCCNT
15AF 5A                  DEC B
15B0 27 13               BEQ    MEM3
15B2 96 7F               LDA A  OP1
15B4 A7 00               STA A  0,X
15B6 08                  INX
15B7 BD 15 E7            JSR    INCCNT
15BA 5A                  DEC B
15BB 27 08               BEQ    MEM3
15BD 96 80               LDA A  OP2
15BF A7 00               STA A  0,X
15C1 08                  INX
15C2 BD 15 E7            JSR    INCCNT
15C5 DF 8B      MEM3     STX    MEMPTR SAVE PLACE
15C7 96 5A               LDA A  DATFLG CHECK FCC,FCB,FDB
15C9 26 01               BNE    EXTDAT IF SO, GO SERVICE
15CB 39         MEM4     RTS           DONE
15CC CE 02 00   EXTDAT   LDX    #BYTSTK
15CF DF 71               STX    XTEMP4 SET BUFFER POINTER
15D1 DE 71      MEM5     LDX    XTEMP4 GET POINTER
15D3 9C 87               CPX    BYTPTR CHECK EMPTY
15D5 27 F4               BEQ    MEM4   IF SO, DONE
15D7 A6 00               LDA A  0,X
15D9 08                  INX
15DA DF 71               STX    XTEMP4 ADVANCE PTR AND SAVE
15DC DE 8B               LDX    MEMPTR GET DEST PTR
15DE A7 00               STA A  0,X    PUT BYTE
15E0 08                  INX
15E1 DF 8B               STX    MEMPTR SAVE PLACE
15E3 8D 02               BSR    INCCNT FIX THE COUNT
```

```
LOCN B1 B2 B3
15E5 20 EA          BRA     MEM5        DO TILL DONE
15E7 96 9B   INCCNT LDA A   MCOUNT+1
15E9 8B 01          ADD A   #1
15EB 97 9B          STA A   MCOUNT+1
15ED 96 9A          LDA A   MCOUNT
15EF 89 00          ADC A   #0
15F1 97 9A          STA A   MCOUNT      16 BIT INCREMENT
15F3 39             RTS
15F4 DE A2   FIXCNT LDX     LASTM       GET LAST START
15F6 96 9A          LDA A   MCOUNT
15F8 A7 00          STA A   0,X
15FA 96 9B          LDA A   MCOUNT+1
15FC A7 01          STA A   1,X         SET BYTE COUNT
15FE 39             RTS                 DONE
                    *
                    *
                    *
                    *
                    END
SYMBOL TABLE:

ADDPC0 0C88  ADDPC1 0C86  ADDPC2 0C7E  ADDPC3 0C72  ADD16  0CFA
ADVPTR 03A6  ASC    13E7  ASMERR 07E5  ASME2  0821  ASME3  0824
ASME4  082B  ASME5  0832  BCONV  12C9  BIN    13BA  BINGO  0962
BIN2   13BC  BUFCNT 00A7  BYTCNT 00A6  BYTPTR 0087  BYTSTK 0200
CERR   047A  CHKCOM 0BAA  CHKERR 0437  CHKFRE 08A4  CHKGEN 14F4
CHKLBL 08DE  CHKLOP 1427  CHKTAP 04ED  CHK1   0939  CHK2   045D
CHK2ER 0433  CHK3   0464  CKDONE 0904  CKSUM  0061  CLRLAB 0C65
CLRLBL 0351  CNXT   0496  CONDON 04BF  CONT   05A5  CONTRL 04B2
COPDON 0CA8  COPLBL 0C8F  CRLF   07CF  DATFLG 005A  DECM   135B
DECM2  1363  DECM3  1387  DECX   04CF  DECXX  1460  DELAY  04C8
DELDON 04D5  DIRECT 0E04  EJCHR  000A  EJECT  1131  EJFLG  005C
EJSTR  11D1  ENDFLG 0058  EQU1   10B9  ERRCNT 00A5  ERRFLG 0056
ERRHD  054B  ERRORS 00A9  ERRPTR 0085  ERRSTK 0100  EVAL   11D5
EVAL1A 11E0  EVAL1B 12A1  EVAL2  12A9  EVAL3  12AD  EVAL4  12BF
EXTDAT 15CC  EXTEND 0D3C  EXTEN0 0D43  EXTEN1 0D49  FCCFLG 005B
FERROR 091A  FILTIT 1114  FIN    04D6  FINDCR 0C26  FINDSC 11E2
FINDSP 0C4F  FINDS2 0C50  FINDS4 11FE  FIN2   0505  FIN3   051E
FIN4   052F  FIN5   0516  FIN6   0537  FIX    0CC1  FIXCNT 15F4
FIXMOD 0D5C  FIXM3  0D67  FIXM4  0D62  FIXM5  0D6D  FIXXX  0E84
FIXXX2 0E01  FNDEND 102D  FNDLBL 0905  FNDOPT 091F  FND10  0908
FND222 0C44  F1     1211  F2     1203  F3     1298  GAP    00AA
GAPX   0531  GENER  00B0  GENOBJ 14FD  GETCHR 0CAC  GETERR 044D
GETER2 046B  GETSYM 057A  GOTLBL 091D  GOTMSG 0664  HASH   0867
HASHCT 00A4  HEADER 1564  HERROR 08B8  HEX    139A  HEXL   0CDB
HEXR   0CDF  HEX2   139C  HEX3   13AA  HEX4   13B9  IMMED  0E3F
IMMED0 0E47  IMMED1 0E4E  IMMED2 0E67  IMMED3 0E6E  IMMED4 0E69
IMMED5 0E76  IMMED6 0E73  INCCNT 15E7  INDEC  1348  INDEC2 1350
INDEX  0DA3  INDEX0 0DF3  INDEX1 0DBA  INDEX2 0DCB  INDEX3 0DD6
INDEX4 0DE0  INDEX5 0DFA  INDEX9 0DF9  INDE00 0DE7  INITR  1388
LABEL  004F  LABERR 0BBC  LABOUT 0584  LASTM  00A2  LASTPC 009E
LBLBEG 0040  LBLEND 0042  LBLMSK 0060  LINBYT 0048  LINCNT 00A8
LINES  0036  LINPTR 008D  LIST   00AE  LNHDX  156F  LOAD   1216
LOAD1  1240  LONE   1393  LOOP   084F  LSTERR 0084  LSTPCM 009C
LSTREC 04F1  LSTSYM 0575  LTEMP  0075  LTWO   1391  L1     1275
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L2	1278	L3	1283	L4	1287	L5	128B	L6	1290
MAIN	0300	MARDON	114C	MATCH1	0952	MATFLG	0057	MCOUNT	009A
MEMCOD	1577	MEMGEN	0414	MEMOBJ	0049	MEMORY	00B3	MEMPTR	008B
MEM1	1594	MEM2	15A3	MEM3	15C5	MEM4	15CB	MEM5	15D1
MESG0	0687	MESG1	069D	MESG10	0778	MESG11	078E	MESG2	06AE
MESG3	06C6	MESG4	06DE	MESG5	06F9	MESG6	0716	MESG7	072F
MESG8	073C	MESG9	0753	MIX2	0882	MIX3	089F	MODFY	00AB
MON	031B	MOVE	150D	MOVELP	143A	MOVPTR	05AD	MSGHD	0681
MSGTBL	0669	NAM1	10F9	NAM2	1110	NAM3	111E	NDIR	0E38
NOEJT	119B	NOERHD	0549	NOERR	0475	NOERR2	049D	NOERR4	04A4
NOLAB	03A4	NOMATL	0942	NOPRT	05AA	NXTBLK	0C5B	NXTBL2	0C5C
NXTBL3	0C64	OBJADR	00A0	OBJBUF	00B4	OBJCOD	1489	OBJC01	1499
OBJC03	14AA	OBJC04	14A8	OBJC05	14B2	OBJC06	14D2	OBJC07	14DD
OBJDON	1517	OBJGEN	040D	OBJINT	0062	OBJLP	1545	OBJPTR	0089
OCT	13D0	OCT1	13D2	OFFLOP	1471	OPADD	12D3	OPCNT	0090
OPCODE	007E	OPDIV	130F	OPDIV1	1325	OPDIV3	1337	OPMUL	12E7
OPMUL2	12F1	OPMUL3	12FF	OPN	0063	OPNEND	1083	OPNPTR	0096
OPNTBL	12C1	OPSERR	07D6	OPSUB	12DD	OPTABL	096B	OPTDON	1040
OPTEND	0B6F	OPTERR	094D	OPTLST	1041	OPTPTR	0094	OP1	007F
OP2	0080	ORDOK	1466	OUTCH	0320	OUTHEX	0CD0	OUTHL	119D
OUTHR	11A3	OUTHXS	0CCC	OUTS	031E	OUTSZ	0CC9	OUT2S	0CC7
OUT3S	0CC5	PAGENO	00AC	PAGER	00B1	PAGFLG	005F	PARFF2	0C4B
PARSE	0B75	PARSE0	0B7F	PARSE1	0BAE	PARSE2	0BD4	PARSE3	0C2D
PARSE4	0C39	PARSE5	0C38	PARSE6	0C36	PARSE7	0C33	PARS0A	0B77
PARS1A	0BC3	PARS1B	0BD1	PARS2A	0C04	PARS2B	0C10	PARS2D	0C11
PARS2E	0C24	PARS2F	0BFF	PARS2H	0C3C	PARS2J	0C1D	PASDON	1477
PASONE	03B1	PASS	008F	PASS1	03B9	PASS11	03C7	PASS12	03CE
PASS13	03D8	PASS2	03E0	PASS2A	03E8	PASS2B	03FA	PASS2C	041B
PASS2X	0401	PASTHR	05BB	PASTWO	03D9	PC	004B	PCFLAG	0059
PCRLF	07BA	PCRLF1	07C8	PCRLF2	07CC	PCTRL	04B6	PDATA	07AB
PEVAL	0BF2	PLOOP	07A7	PPAG2	1174	PPAG3	1196	PPAG4	1183
PPAG5	117F	PPAG6	116F	PPP	11A9	PRFLG	0055	PRTDAT	05FF
PRTERR	0651	PRTFLG	005E	PRTINA	05CF	PRTINB	05D5	PRTINC	05D7
PRTIND	05CE	PRTINE	05D3	PRTINF	05C1	PRTING	05F8	PRTIT	0CD8
PRTMAR	1146	PRTMES	04EA	PRTPC	0611	PRTREC	1518	PRTSRC	0642
PRTS1	0644	PRTS2	0650	PRT1	0636	PRT2	0639	PRT2ER	048F
PRT3	063C	PRT4	063F	PSTR	07B2	PTNXT	0660	PUTIT	08BB
PUTLBL	08A2	P1INIT	0326	P2DON	04B1	P2ERR1	0081	P2ERR2	0082
P2ERR3	0083	P2INIT	036F	P2IN3	03B0	P3FLG	005D	P3INIT	036F
QTEMP	007B	QTEMP2	0079	QTEMP3	0077	RANDOM	084B	RECORD	151C
REHASH	087F	RNDM	0091	SAME	1481	SAVEPL	1515	SAVPTR	0098
SETBIT	039C	SETGAP	1403	SETTL	035D	SET0	0512	SHELL	13F0
SHELL1	13FC	SHELL2	1401	SHELL5	1458	SHELL6	146D	SHIFTL	150B
SHORT	0422	SORT	141D	SPCL	1351	SPSAVE	0067	SRCBEG	0044
SRCEND	0046	SRCPTR	004D	SRTDON	1480	SUB16	0CE8	SYMBOL	00AF
SYMGEN	055E	SYMHD	0538	SYMPRT	05B8	TAPBYT	1550	TAPE	00B2
TAPEOF	04C4	TAPEON	04C0	TAPOUT	0323	TEMP	007D	TERM	0064
TFIXMD	0D59	TITLE	00C6	TOOMAN	0836	TYPERR	0FEA	TYPE1	0D03
TYPE10	0F7E	TYPE11	0FBD	TYPE12	0FED	TYPE13	1089	TYPE14	10A2
TYPE15	10B0	TYPE16	10DD	TYPE17	10E9	TYPE18	111F	TYPE2	0D06
TYPE2A	0D28	TYPE2B	0D2C	TYPE2D	0D34	TYPE3	0D35	TYPE3A	0D39
TYPE4	0D54	TYPE5	0D51	TYPE6	0D7B	TYPE7	0D88	TYPE7A	0D8D
TYPE7C	0D9C	TYPE7D	0D96	TYPE8	0E87	TYPE8A	0EB1	TYPE8B	0EBE
TYPE8C	0ED6	TYPE8D	0ED4	TYPE8E	0EC4	TYPE8F	0EF1	TYPE8G	0F06
TYPE8H	0F0D	TYPE8I	0F2C	TYPE8J	0F38	TYPE8K	0F34	TYPE8L	0F3A
TYPE9	0F42	TYPE9A	0F62	TYPE9B	0F68	TYPE9C	0F4E	TYPE9D	0F5D
TYP10A	0F8A	TYP10B	0F9E	TYP10C	0F99	TYP11A	0FD9	TYP11B	0FE3
TYP11C	0FE9	TYP12A	1005	TYP12B	1019	TYP12C	1009	TYP12D	0FF8
TYP13A	10A1	TYP15A	10B4	TYP15C	10D7	TYP3R	0D4C	XLOOP	04CC

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XSAVE  0065   XTEMP  0069   XTEMP1 006B   XTEMP2 006D   XTEMP3 006F
XTEMP4 0071   XTEMP5 0073
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OBJECT CODE:

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S1 13 0330 40 97 A8 4F 97 B1 97 AC 97 AD 97 A5 97 56 97 B2 AA
S1 13 0340 97 B3 97 58 97 A9 86 7F 97 60 CE 01 00 DF 85 DE 23
S1 13 0350 40 6F 00 08 9C 42 26 F9 CE 00 C6 86 20 A7 00 08 FC
S1 13 0360 8C 00 E6 26 F8 86 04 A7 00 CE 00 00 DF 4B 39 86 11
S1 13 0370 FF 97 62 97 5D CE 01 00 DF 85 CE 00 00 DF 4B CE 94
S1 13 0380 FF FF DF 9C DF 9E 4F 97 A7 97 9A 97 9B 97 58 CE C6
S1 13 0390 00 B4 DF 89 DE 49 DF 8B DF A2 DE 40 A6 00 27 04 3C
S1 13 03A0 8A 80 A7 00 C6 08 08 9C 42 27 05 5A 26 F8 20 EC 34
S1 13 03B0 39 9F 67 DE 44 09 7F 00 8F DF 4D BD 0B 75 DF 6F 0A
S1 13 03C0 96 4F 27 03 BD 08 A2 96 55 26 03 BD 0C 44 DE 6F 45
S1 13 03D0 96 58 26 04 9C 46 26 E1 39 DE 44 09 86 01 97 8F 07
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S1 13 03F0 09 BD 09 05 A6 00 84 7F A7 00 96 55 26 03 BD 09 FB
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S1 13 0420 04 A4 96 5E 27 0D 96 AE 27 09 96 90 36 BD 05 C1 A5
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S1 13 0D3C 96 8F 27 09 BD 11 D5 DE 7B DF 7F 8D 13 7E 0C 72 58
S1 13 0D4C 86 03 7E 07 D6 BD 0E 3F BD 0E 04 20 E0 8D 01 39 0F
S1 13 0D5C D6 7E C1 80 24 05 96 AB 26 36 39 C4 0F C1 0B 22 2E
S1 13 0D6C F5 96 AB 27 2B 4A 40 84 40 9B 7E 97 7E 4F 39 96 51
S1 13 0D7C AB 4A 2A 0D D6 7E CB 20 D7 7E 20 B1 96 AB 4A 2B 1C
S1 13 0D8C BF D6 7E C1 3F 23 03 40 84 10 1B 97 7E 7E 0C 86 06
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S1 13 0D9C 31 31 86 03 7E 07 D6 DE 6B 7F 00 7F A6 00 81 58 37
S1 13 0DAC 26 0C A6 01 81 20 27 22 81 0D 26 02 20 1C A6 00 D8
S1 13 0DBC 81 2C 27 20 81 20 27 2F 81 0D 27 2B 08 20 EF 96 AB
S1 13 0DCC 8F 27 07 BD 11 D5 96 7C 97 7F BD 0D 59 26 26 31 EB
S1 13 0DDC 31 7E 0C 7E A6 01 81 58 26 14 08 A6 01 81 20 27 99
S1 13 0DEC DE 81 0D 27 DA 20 07 D6 7E CB 10 D7 7E 39 86 08 14
S1 13 0DFC 31 31 7E 07 D6 31 31 39 DE 6B 86 FF 97 56 97 60 D9
S1 13 0E0C DF 73 BD 11 D5 7F 00 56 C6 7F D7 60 DE 6B E6 00 5D
S1 13 0E1C C1 2C 36 07 DE 73 DF 6B 33 06 27 10 5D 26 0D D6 27
S1 13 0E2C 7B 26 09 BD 0D 59 26 50 96 7C 20 2F D6 7E CB 10 DF
S1 13 0E3C D7 7E 39 DE 6B A6 00 81 23 27 07 D6 7E CB 10 D7 4D
S1 13 0E4C 7E 39 08 DF 6B D6 7E C4 0F C1 0B 22 15 BD 0D 59 3C
S1 13 0E5C 26 26 96 8F 27 07 BD 11 D5 96 7C 97 7F BD 0C 7E D1
S1 13 0E6C 20 16 96 AB 4A 2B 03 7E 0D 9C BD 0C 72 96 8F 27 D5
S1 13 0E7C 07 BD 11 D5 DE 7B DF 7F 31 31 39 86 FF 97 56 DE 16
S1 13 0E8C 96 DF 73 BD 11 D5 CE 02 00 DF 87 96 7C 27 56 DE 24
S1 13 0E9C 6B A6 00 81 2C 26 4E 08 96 7C E6 00 08 C1 0D 26 14
S1 13 0EAC 04 97 5B C6 20 D7 7E DF 71 BD 0C 86 DE 71 4A 26 A3
S1 13 0EBC 01 39 97 5A 86 01 97 A6 E6 00 08 DF 71 7D 00 5B 1D
S1 13 0ECC 26 06 C1 0D 26 04 97 5B C6 20 DE 87 E7 00 08 DF E3
S1 13 0EDC 87 BD 0C 86 DE 71 7A 00 5A 26 DD 86 01 97 90 97 C1
S1 13 0EEC 5A 7F 00 56 39 DE 73 E6 00 08 A6 00 97 7E DF 71 40
S1 13 0EFC BD 0C 86 DE 71 E1 01 26 01 39 D7 5A 86 01 97 A6 0D
S1 13 0F0C 08 A6 00 08 DF 71 DE 87 11 27 15 81 0D 27 11 A7 AC
S1 13 0F1C 00 08 DF 87 8C 03 00 27 13 BD 0C 86 DE 71 20 E1 EB
S1 13 0F2C 7F 00 56 86 01 97 90 39 8D 63 20 02 8D F2 7F 00 E5
S1 13 0F3C 56 86 0B 7E 07 E5 CE 02 00 DF 87 BD 0B F2 96 7C 4E
S1 13 0F4C 97 7E BD 0C 86 DE 6B A6 00 81 0D 27 04 81 2C 27 B1
S1 13 0F5C 05 86 01 97 90 39 97 5A 86 01 97 A6 08 DF 6B BD D1
S1 13 0F6C 0B F2 DE 87 96 7C A7 00 08 DF 87 8C 03 00 27 BC 76
S1 13 0F7C 20 D0 CE 02 00 DF 87 BD 0B F2 DE 7B DF 7E BD 0C 02
S1 13 0F8C 7E DE 6B A6 00 81 0D 27 04 81 2C 27 05 86 02 97 33
S1 13 0F9C 90 39 97 5A 86 02 97 A6 08 DF 6B BD 0B F2 DE 87 51
S1 13 0FAC 96 7B A7 00 96 7C A7 01 08 08 DF 87 8C 03 00 20 9A
S1 13 0FBC CD 7F 00 59 96 8F 27 25 96 5D 27 21 96 4F 26 1E A7
S1 13 0FCC 96 AE 27 19 BD 11 D5 D6 7C 26 02 C6 01 BD 07 BA 2B
S1 13 0FDC 96 5C 26 03 5A 26 F6 7F 00 5C 7F 00 5E 39 7E 10 F1
S1 13 0FEC B4 7F 00 59 96 8F 26 F5 96 4F 26 F2 DE 6B A6 02 37
S1 13 0FFC 97 7D A6 00 E6 01 CE 10 41 A1 00 27 10 08 08 08 31
S1 13 100C 08 08 08 8C 10 89 26 F1 86 0A 7E 07 E5 E1 01 26 7A
S1 13 101C EC 36 96 7D A1 02 32 26 E4 A6 03 EE 04 A7 00 DE 8C
S1 13 102C 6B A6 00 08 DF 6B 81 0D 27 0A 81 20 27 06 81 2C 13
S1 13 103C 27 BA 20 ED 39 4C 49 53 FF 00 AE 4E 4F 4C 00 00 FB
S1 13 104C AE 54 41 50 FF 00 B2 4E 4F 54 00 00 B2 4D 45 4D CA
S1 13 105C FF 00 B3 4E 4F 4D 00 00 B3 53 59 4D FF 00 AF 4E 3C
S1 13 106C 4F 53 00 00 AF 47 45 4E FF 00 B0 4E 4F 47 00 00 B2
S1 13 107C B0 50 41 47 FF 00 B1 4E 4F 50 00 00 B1 7F 00 59 B2
S1 13 108C 96 8F 27 11 96 4F 26 20 97 5E 96 B1 27 07 96 AE 1A
S1 13 109C 27 03 7F 00 5F 39 96 4F 26 0E BD 11 D5 DE 7B DF 0B
S1 13 10AC 4B DF 6D 39 96 4F 26 05 86 07 7E 07 E5 BD 09 05 8E
S1 13 10BC DF FD 96 8F 4A 97 56 BD 11 D5 7F 00 56 DE FD 96 FF
S1 13 10CC 7C D6 7B E7 06 A7 07 DE 7B DF 6D 39 96 84 7E 07 2B
S1 13 10DC E5 7F 00 59 96 4F 26 D0 86 FF 97 58 39 7F 00 59 E3
S1 13 10EC 96 8F 27 2E 96 4F 26 C0 CE 00 C6 DF 65 DE 96 A6 B9
S1 13 10FC 00 81 0D 27 0F 08 DF 96 DE 65 A7 00 08 DF 65 8C DD
S1 13 110C 00 E6 26 E9 86 20 DE 65 8C 00 E6 27 05 A7 00 08 A4
S1 13 111C 20 F6 39 BD 11 D5 CE 00 7B D6 4C 96 4B BD 0C FA BE
S1 13 112C DE 7B DF 4B 39 37 D6 B1 27 65 CE 11 D1 BD 07 AB 8A
S1 13 113C 37 4F 97 A8 97 B1 C6 03 27 06 BD 07 BA 5A 26 FA A4
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S1 13 114C CE 00 C6 BD 07 AB CE 11 A9 BD 07 AB 96 AD 8B 01 C6
S1 13 115C 19 97 AD 96 AC 89 00 19 97 AC 27 0C 84 F0 27 03 2A
S1 13 116C 8D 2F 5C 96 AC 8D 30 5C 96 AD 27 1E 5D 26 04 85 68
S1 13 117C F0 27 04 8D 1C 96 AD 8D 1E BD 07 BA BD 07 BA 86 2B
S1 13 118C FF 97 5C 97 5F 33 D7 B1 33 39 5D 26 E6 20 E8 33 9C
S1 13 119C 39 BD 0C DB 7E 03 20 BD 0C DF 7E 03 20 20 20 20 18
S1 13 11AC 20 20 20 20 20 54 53 43 20 4D 4E 45 4D 4F 4E 49 72
S1 13 11BC 43 20 41 53 53 45 4D 42 4C 45 52 20 20 20 20 50 4E
S1 13 11CC 41 47 45 20 04 00 00 0A 04 4F 97 7B 97 7C 97 63 A2
S1 13 11DC DE 6B DF 96 DE 96 A6 00 08 5F 81 2B 27 27 5C 81 E9
S1 13 11EC 2D 27 22 5C 81 2A 26 0A 09 9C 96 07 08 06 27 E6 E5
S1 13 11FC 20 13 5C 81 2F 27 0E C6 FF 81 20 27 08 81 2C 27 02
S1 13 120C 04 81 0D 26 D1 D7 64 09 DF 6B DE 96 7F 00 7D A6 A1
S1 13 121C 00 81 41 25 1F 81 5A 22 1B DF 79 BD 0C 65 DE 79 C3
S1 13 122C BD 0C 8F BD 09 05 EE 06 DF 79 DE 6B 4D 2A 50 86 A9
S1 13 123C 01 7E 12 98 C6 01 81 24 27 2F 5C 81 25 27 2A 5C 04
S1 13 124C 81 40 27 25 5C 81 27 27 20 DE 6B 09 7C 00 7D 5A 91
S1 13 125C A6 00 81 4F 27 16 81 51 27 12 5A 81 42 27 0D 5A 15
S1 13 126C 81 48 27 08 5A D7 7D 20 03 08 DF 96 4F 97 79 97 32
S1 13 127C 7A CE 12 C9 58 27 04 08 5A 26 FC EE 00 AD 00 96 03
S1 13 128C 7D 27 01 08 DF 71 9C 6B 27 0B 86 09 7F 00 7B 7F 10
S1 13 129C 00 7C 7E 07 E5 96 63 CE 12 C1 48 27 04 08 4A 26 D3
S1 13 12AC FC EE 00 AD 00 DE 6B 08 DF 96 96 64 97 63 2B 03 AF
S1 13 12BC 7E 11 E0 4F 39 12 D3 12 DD 12 E7 13 0F 13 5B 13 B7
S1 13 12CC 9A 13 BA 13 D0 13 E7 96 79 D6 7A CE 00 7B 7E 0C 98
S1 13 12DC FA 96 79 D6 7A CE 00 7B 7E 0C E8 CE 00 00 DF 77 C6
S1 13 12EC CE 00 77 C6 10 A6 03 46 24 09 37 A6 04 E6 05 BD 2E
S1 13 12FC 0C FA 33 64 00 66 01 66 02 66 03 5A 26 E7 EE 02 B2
S1 13 130C DF 7B 39 CE 00 00 DF 77 DE 79 D6 7C D7 7A D6 7B CB
S1 13 131C D7 79 DF 7B C6 11 CE 00 77 37 96 7B D6 7C BD 0C 94
S1 13 132C E8 25 08 96 7B D6 7C BD 0C FA 0C 69 03 69 02 69 26
S1 13 133C 01 69 00 33 5A 26 E2 EE 02 DF 7B 39 E6 00 C0 3A 3B
S1 13 134C 24 02 CB 0A 39 96 6D 97 79 96 6E 97 7A 08 39 8D 63
S1 13 135C 2B A6 00 81 2A 27 EE 8D E3 24 20 37 96 79 D6 7A A2
S1 13 136C 8D 25 8D 23 DB 7A D7 7A 99 79 97 79 8D 19 33 4F 1B
S1 13 137C DB 7A 99 79 D7 7A 97 79 08 20 DC 39 DE 96 7F 00 65
S1 13 138C 79 7F 00 7A 39 8D 00 78 00 7A 79 00 79 39 8D EC 7F
S1 13 139C A6 00 80 47 2A 17 8B 06 2A 04 8B 07 2A 0F 8B 0A 70
S1 13 13AC 2B 0B 8D E1 8D DF 9B 7A 97 7A 08 20 E3 39 8D CC 5A
S1 13 13BC A6 00 80 30 2B F7 81 01 22 F3 46 79 00 7A 79 00 5C
S1 13 13CC 79 08 20 EC 8D B6 A6 00 80 30 2B E1 81 07 22 DD 54
S1 13 13DC 8D B3 8D B3 9B 7A 97 7A 08 20 EB 8D 9F A6 00 97 DB
S1 13 13EC 7A DE 6B 39 7F 00 7D 86 08 36 86 20 36 86 68 36 31
S1 13 13FC 32 97 AA DE 40 DF 77 DF 7B 96 7C 9B AA 97 7A 96 9E
S1 13 140C 7B 89 00 97 79 91 42 25 08 26 60 96 7A 91 43 24 2A
S1 13 141C 5A C6 06 DE 7B DF 69 DE 79 DF 6D DE 69 A6 00 08 5D
S1 13 142C DF 69 DE 6D A1 00 27 4D 23 30 C6 08 DE 7B DF 69 42
S1 13 143C 37 A6 00 DE 79 E6 00 A7 00 08 DF 79 DE 69 E7 00 4D
S1 13 144C 08 33 5A 26 E9 96 7D 26 03 73 00 7D DE 7B 9C 40 87
S1 13 145C 27 08 C6 08 09 5A 26 FC 20 9D 96 7D 27 03 7F 00 81
S1 13 146C 7D DE 77 C6 08 08 5A 26 FC 20 8A 96 AA 81 08 27 AE
S1 13 147C 03 7E 13 FC 39 08 DF 6D 5A 26 A0 20 DD 96 62 27 03
S1 13 148C 0C CE 04 C0 BD 04 B2 BD 04 C8 7F 00 62 DE 6D 9C EA
S1 13 149C 9E 07 DE 4B DF 9E 06 27 03 BD 15 18 96 90 D6 A7 34
S1 13 14AC 26 04 DE 6D DF A0 DE 89 D6 7E E7 00 08 7C 00 A7 6B
S1 13 14BC 4A 27 13 D6 7F E7 00 08 7C 00 A7 4A 27 08 D6 80 62
S1 13 14CC E7 00 08 7C 00 A7 8D 20 96 5A 27 3F CE 02 00 DF 48
S1 13 14DC 71 DE 71 9C 87 27 34 A6 00 08 DF 71 DE 89 A7 00 B2
S1 13 14EC 08 7C 00 A7 8D 02 20 E9 DF 89 96 A7 81 0F 22 01 D1
```

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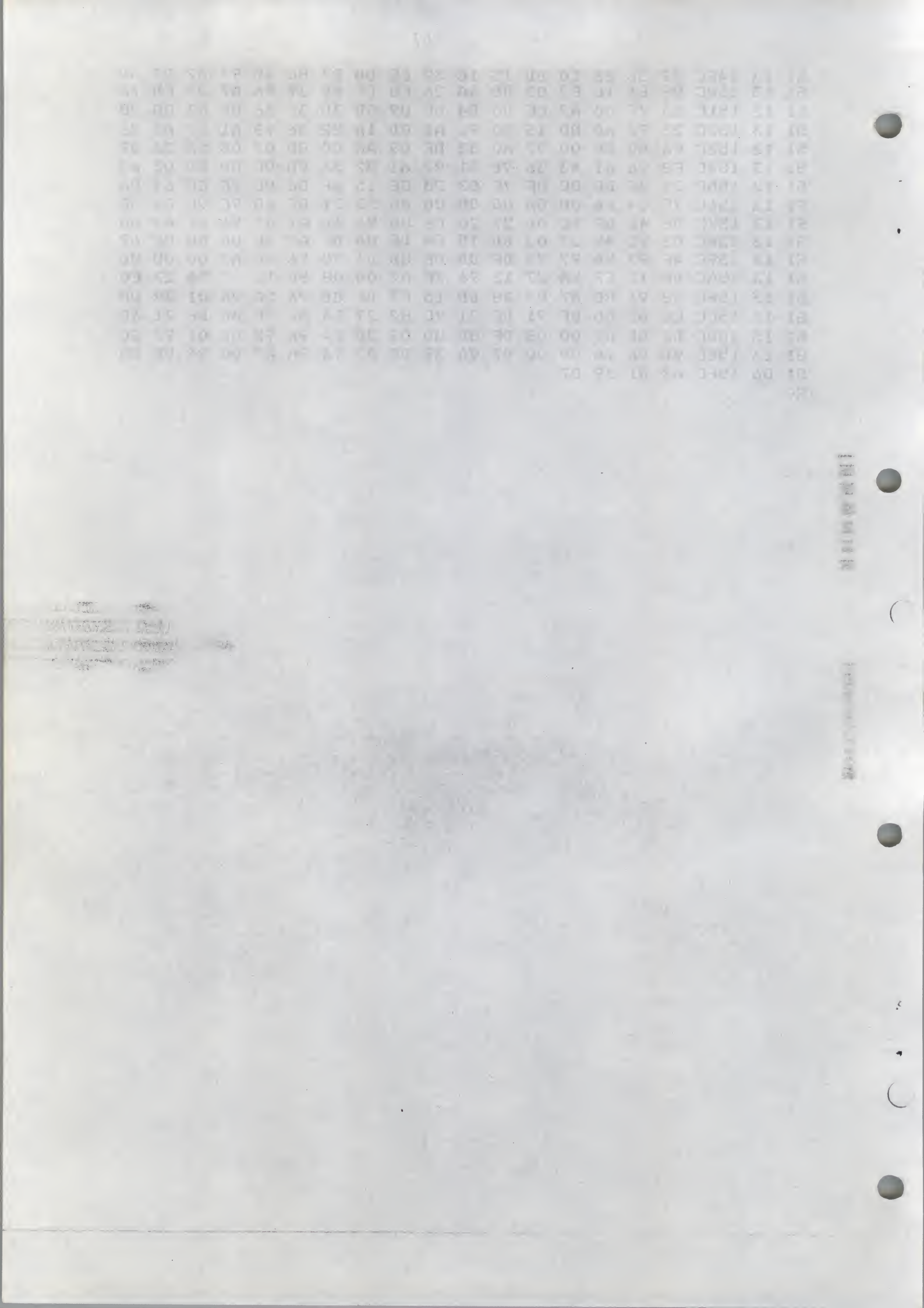
S1 13 14FC 39 36 86 10 BD 15 1C 32 CE 00 B4 80 10 97 A7 27 40
S1 13 150C 08 E6 10 E7 00 08 4A 26 F8 DF 89 39 96 A7 27 FB 76
S1 13 151C 36 7F 00 A7 CE 00 B4 DF 89 8D 3D 32 36 8B 03 8D 28
S1 13 152C 23 96 A0 BD 15 50 96 A1 8D 1A 32 36 9B A1 97 A1 76
S1 13 153C 96 A0 89 00 97 A0 33 DE 89 A6 00 8D 07 08 5A 26 49
S1 13 154C F8 96 61 43 36 9B 61 97 61 32 36 BD 0C DB BD 03 63
S1 13 155C 23 32 BD 0C DF 7E 03 23 CE 15 6F C6 08 7F 00 61 DA
S1 13 156C 7E 04 B6 0D 0A 00 00 00 00 53 31 DE 6D 9C 9C 07 0E
S1 13 157C DE 4B DF 9C 06 27 20 DE 8B 96 6D A7 02 96 6E A7 AA
S1 13 158C 03 9C 49 27 03 BD 15 F4 DE 8B DF A2 08 08 08 08 69
S1 13 159C 4F 97 9A 97 9B DF 8B DE 8B D6 90 96 7E A7 00 08 8D
S1 13 15AC BD 15 E7 5A 27 13 96 7F A7 00 08 BD 15 E7 5A 27 E0
S1 13 15BC 08 96 80 A7 00 08 BD 15 E7 DF 8B 96 5A 26 01 39 DB
S1 13 15CC CE 02 00 DF 71 DE 71 9C 87 27 F4 A6 00 08 DF 71 60
S1 13 15DC DE 8B A7 00 08 DF 8B 8D 02 20 EA 96 9B 8B 01 97 8C
S1 13 15EC 9B 96 9A 89 00 97 9A 39 DE A2 96 9A A7 00 96 9B A5
S1 06 15FC A7 01 39 07
S9
```



```
* TSC EDITOR-ASSEMBLER CORESIDENT LINK
*
* COPYRIGHT (C) 1977 BY
* TECHNICAL SYSTEMS CONSULTANTS, INC.
* P.O. BOX 2574; W. LAFAYETTE, IN 47906
* (317) 742-7509
*
* THE PURPOSE OF THIS PROGRAM IS TO SETUP THE NECESSARY
* POINTERS IN THE TSC ASSEMBLER AND TO SAVE CERTAIN
* POINTERS OF THE TSC EDITOR TO ALLOW THEM TO RUN CO-
* RESIDENT.  WHEN IN THE EDITOR AND READY TO ASSEMBLE
* YOUR FILE, TYPE 'LAS' FOR 'LINK ASSEMBLER'.  YOU WILL
* BE ASKED 'LISTING OR TAPE?'.  AN 'L' WILL GIVE YOU A
* LISTING WHILE A 'T' WILL PRODUCE A MIKBUG FORMAT TAPE.
* WHEN THE ASSEMBLY IS COMPLETE, CONTROL WILL RETURN TO
* THE EDITOR.  USING LAS DELETES THE LOG COMMAND FROM THE
* EDITOR.  YOU MAY STILL USE STOP TO EXIT.  THIS LINK
* PROGRAM ASSUMES THE 'MEM' OPTION OF THE ASSEMBLER WILL
* NOT BE USED.  IF YOU DO WISH TO USE IT, EXIT THE PROGRAM
* WHEN ASKED 'LISTING OR TAPE?' AND SET UP THE MEM OPTION
* POINTER.  THEN RESUME EXECUTION AT $150F IN THE LINK
* (OR $2A0F AFTER RELOCATION).  THIS PROGRAM IS SETUP FOR
* A 16K SYSTEM.  IF YOU HAVE A LARGER SYSTEM, CHANGE
* MEMEND IN THE EDITOR ($0212 BEFORE RELOCATION; $1712
* AFTER) AND SETUP AN ADEQUATE SYMBOL TABLE BY CHANGING
* THE TABLE BEGIN POINTER AT $14BD (OR $29BD AFTER RELO-
* CATION) AND THE TABLE END POINTER AT $14BF (OR $29BF
* AFTER RELOCATION).  BE SURE THE NUMBER OF BYTES IN THE
* TABLE IS A MULTIPLE OF 8.
*
                * CHANGES TO EDITOR

0212                        ORG     $0212
0212 3A FF (57FF)           FDB     $3AFF       SET MEMORY END
028E                        ORG     $028E
028E 4C                     FCC     'LAS'       PUT LAS IN COMMAND TABLE
028F 41 53
0291 00                     FCB     0
0292 14 D3                  FDB     LAS

0358                        ORG     $0358
0358 CE 15 59               LDX     #BEGPT2     SETUP NEW BEGIN PTR

                * EXTERNAL EQUATES

1491                        ORG     $1491
0326            P1INIT      EQU     $0326
03B1            PASONE      EQU     $03B1
036F            P2INIT      EQU     $036F
03D9            PASTWO      EQU     $03D9
036F            P3INIT      EQU     $036F
```

```
05BB                PASTHR  EQU     $05BB
0040                LBLBEG  EQU     $0040
0042                LBLEND  EQU     $0042
0044                SRCBEG  EQU     $0044
0046                SRCEND  EQU     $0046
0048                LINBYT  EQU     $0048
0097                FILBEG  EQU     $0097
0099                FILEND  EQU     $0099
005E                ZONE1   EQU     $005E
0060                ZONE2   EQU     $0060
006A                NUMFLG  EQU     $006A
008F                INZFLG  EQU     $008F
00BB                BUFFER  EQU     $00BB
0058                SPCPT1  EQU     $0058
0096                HEDCNT  EQU     $0096
0040                TEMP    EQU     $0040
0C62                MAKSP5  EQU     $0C62
0203                RESTRT  EQU     $0203
0206                INCH    EQU     $0206
0483                PSTRNG  EQU     $0483

                    * TEMPORARY STORAGE

1491                ZONE1X  RMB     2
1493                ZONE2X  RMB     2
1495                NMFG2   RMB     2
1497      (5800)    TMPEND  RMB     37
14BC                TMPBEG  RMB     1
(2900) 14BD 3B 00 4B 00 LBLBG2  FDB     $3B00       LABEL TABLE BEGIN ADDR.
14BF 3F FF 41FFF LBLED2 FDB     $3FFF       LABEL TABLE END ADDR.
14C1 4C    (5FFF)LSTORT FCC     'LISTING OR TAPE? '
14C2 49 53
14C4 54 49
14C6 4E 47
14C8 20 4F
14CA 52 20
14CC 54 41
14CE 50 45
14D0 3F 20
14D2 04             FCB     4

                    * ENTRY POINT UPON EXITING THE EDITOR

14D3 DE 97          LAS     LDX     FILBEG      GET FILE BEGIN
14D5 9C 99                  CPX     FILEND      ANY SOURCE IN FILE?
14D7 27 7C                  BEQ     RSTART      IF NOT, BACK TO EDITOR
14D9 DF 44                  STX     SRCBEG      SET SOURCE BEGIN
14DB DE 99                  LDX     FILEND      SET SOURCE END
14DD 09                     DEX
14DE DF 46                  STX     SRCEND
14E0 86 03                  LDA A   #3          SET LINE BYTE COUNT
14E2 97 48                  STA A   LINBYT
14E4 CE 00 BB               LDX     #BUFFER     SAVE EDITOR DATA
14E7 DF 58                  STX     SPCPT1
```

```
14E9 CE 00 96            LDX    #HEDCNT
14EC DF 40               STX    TEMP
14EE CE 14 BC            LDX    #TMPBEG
14F1 BD 0C 62            JSR    MAKSP5
14F4 DE 5E               LDX    ZONE1       SAVE ZONE1
14F6 FF 14 91            STX    ZONE1X
14F9 DE 60               LDX    ZONE2       SAVE ZONE2
14FB FF 14 93            STX    ZONE2X
14FE DE 6A               LDX    NUMFLG      SAVE NUMBER & VERIFY
1500 FF 14 95            STX    NMFG2
1503 FE 14 BD            LDX    LBLBG2      SET LABEL TABLE BEGIN
1506 DF 40               STX    LBLBEG
1508 FE 14 BF            LDX    LBLED2      SET LABEL TABLE END
150B DF 42               STX    LBLEND
150D BD 03 26            JSR    P1INIT      DO PASS 1 INITIALIZE
1510 BD 03 B1            JSR    PASONE      DO PASS 1
1513 CE 14 C1            LDX    #LSTORT     ASK 'LISTING OR TAPE?'
1516 BD 04 83            JSR    PSTRNG
1519 FE 14 BF            LDX    LBLED2      RESET LABEL END
151C DF 42               STX    LBLEND
151E BD 02 06            JSR    INCH        GET RESPONSE
1521 81 54               CMP A  #'T
1523 27 08               BEQ    TAPE
1525 BD 03 6F            JSR    P2INIT      IF LISTING, DO PASS 2
1528 BD 03 D9            JSR    PASTWO
152B 20 06               BRA    EDITOR
152D BD 03 6F  TAPE      JSR    P3INIT      IF TAPE, DO PASS 3
1530 BD 05 BB            JSR    PASTHR

                 * REENTRY POINT ON EXIT FROM ASSEMBLER

1533 4F        EDITOR    CLR A              CLEAR FLAG
1534 97 8F               STA A  INZFLG
1536 CE 14 BC            LDX    #TMPBEG     RESTORE EDITOR DATA
1539 DF 58               STX    SPCPT1
153B CE 14 97            LDX    #TMPEND
153E DF 40               STX    TEMP
1540 CE 00 BB            LDX    #BUFFER
1543 BD 0C 62            JSR    MAKSP5
1546 FE 14 91            LDX    ZONE1X      RESTORE ZONE1
1549 DF 5E               STX    ZONE1
154B FE 14 93            LDX    ZONE2X      RESTORE ZONE2
154E DF 60               STX    ZONE2
1550 FE 14 95            LDX    NMFG2       RESTORE NUMBER & VERIFY
1553 DF 6A               STX    NUMFLG
1555 7E 02 03  RSTART    JMP    RESTRT      JUMP INTO EDITOR


1558 0D                  FCB    $0D

1559           BEGPT2    EQU    *           START OF FILESPACE

                         END
      NO ERROR(S) DETECTED
```

SYMBOL TABLE:

BEGPT2	1559	BUFFER	00BB	EDITOR	1533	FILBEG	0097
FILEND	0099	HEDCNT	0096	INCH	0206	INZFLG	008F
LAS	14D3	LBLBEG	0040	LBLBG2	14BD	LBLED2	14BF
LBLEND	0042	LINBYT	0048	LSTORT	14C1	MAKSP5	0C62
NMFG2	1495	NUMFLG	006A	P1INIT	0326	P2INIT	036F
P3INIT	036F	PASONE	03B1	PASTHR	05BB	PASTWO	03D9
PSTRNG	0483	RESTRT	0203	RSTART	1555	SRCPT1	0058
SRCBEG	0044	SRCEND	0046	TAPE	152D	TEMP	0040
TMPBEG	14BC	TMPEND	1497	ZONE1	005E	ZONE1X	1491
ZONE2	0060	ZONE2X	1493				

OBJECT CODE:

```
S1 05 0212 3A FF AD
S1 09 028E 4C 41 53 00 14 D3 9F
S1 06 0358 CE 15 59 62
S1 13 14BD 3B 00 3F FF 4C 49 53 54 49 4E 47 20 4F 52 20 54 53
S1 13 14CD 41 50 45 3F 20 04 DE 97 9C 99 27 7C DF 44 DE 99 EB
S1 13 14DD 09 DF 46 86 03 97 48 CE 00 BB DF 58 CE 00 96 DF 62
S1 13 14ED 40 CE 14 BC BD 0C 62 DE 5E FF 14 91 DE 60 FF 14 B1
S1 13 14FD 93 DE 6A FF 14 95 FE 14 BD DF 40 FE 14 BF DF 42 78
S1 13 150D BD 03 26 BD 03 B1 CE 14 C1 BD 04 83 FE 14 BF DF DC
S1 13 151D 42 BD 02 06 81 54 27 08 BD 03 6F BD 03 D9 20 06 C1
S1 13 152D BD 03 6F BD 05 BB 4F 97 8F CE 14 BC DF 58 CE 14 D2
S1 13 153D 97 DF 40 CE 00 BB BD 0C 62 FE 14 91 DF 5E FE 14 3E
S1 0F 154D 93 DF 60 FE 14 95 DF 6A 7E 02 03 0D 3C
S9
```

THE TSC 6800 RELOCATOR

SL68-28

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(317) 742-7509

The TSC 6800 RELOCATOR is a very useful tool for any system owner, especially those who do assembly language programming. It can move blocks of information from one location in RAM to another. It can also relocate machine code programs from one place in RAM to another or from tape into RAM. Many variations are possible as you will see from using the RELOCATOR. The program is very easy to use as it prompts the user for all the information it needs. This manual explains the prompts and what they require in response. Included are 2 example relocations and the information necessary to relocate other TSC software. Also included is a co-resident link for the TSC TEXT EDITING SYSTEM and the TSC MNEMONIC ASSEMBLER.

First of all, here are some hints on how to respond to computer prompts. When asked a question by the computer, in general type a 'Y' for yes or an 'N' for no. When entering addresses, it is not necessary to type leading zeros. A return must be typed to terminate the address. Note that only the last 4 digits typed are accepted. Thus if you detect an error in typing before hitting a return, you can type a few zeros and then type the correct address.

WHAT THE PROMPTS MEAN:

1. PRESENT PROGRAM; BEGIN ADDRESS? ... Hexadecimal address of the first byte to be relocated.

2. PRESENT PROGRAM; END ADDRESS? ... Hexadecimal address of the last byte to be relocated.

3. MOVE TO? ... Hexadecimal address of the location to which you are moving the present program.

4. FIX REFERENCES? ... Typing an 'N' will cause the program delimited in steps 1 and 2 above to be moved exactly as is, byte for byte, to the location specified in step 3 above. You will then exit the RELOCATOR. A 'Y' will allow the program to be relocated, fixing any extended addressing references that require a change. For a further description, read the section titled 'FIXING REFERENCES'.

5. LOAD FROM TAPE? ... Type an 'N' if the program you are relocating is in RAM If you are relocating directly from tape, type a 'Y'. The program will go into a load mode, much as if you had typed an 'L' into a MIKBUG monitor. If there is an error during loading, you will be prompted 'LOAD ERROR! TRY AGAIN?'. Typing a 'Y' at this point will put you back into the load mode. An 'N' will cause an exit from the relocator program. If there are no load errors, upon receiving an 'S9' the computer will report, ' LOAD COMPLETED.' At this point the RELOCATOR will pause until you type a space.

6. DATA BLOCKS? ... If the program you are relocating is made of executable code only, type an 'N'. If there are blocks of data, print strings or etc., type a 'Y'. You will then be asked for 'BEGIN ADDRESS' and 'END ADDRESS' for as many blocks as you wish to enter. THESE BLOCKS MUST BE ENTERED IN ORDER. That is, the block with the lowest starting address must come first, the second lowest starting address comes next, and so on. To end the entering process, enter an 'FFFF' as the begin address of a block For a more complete description of what is considered a 'data block,' see the section titled 'DATA BLOCKS'
   NOTE: These addresses are placed on a stack beginning at the end of the RELOCATOR ($06AD). Be sure you have enough RAM there for the number of blocks you enter!

7. ALTER RANGE? ... The 'range' is initially set to the beginning and the end of the program you are moving. This means that any JMP, JSR or other extended address instruction within that range will have an offset added to its reference (2nd and 3rd bytes) when relocated. Any extended instruction outside the range will be moved exactly as is, thus allowing monitor calls, external routine calls, etc. to be properly relocated. If you want the range left as is, type an 'N'. If you wish to change it, type a 'Y'. You will then be asked for the beginning and ending addresses of the new range.

8. FIX FDB'S? ... An FDB is a pseudo-op in standard 6800 assemblers. Its function is to define 2 bytes of RAM to be some specific value. If there are no FDB's in your program, type an 'N' and you are finished. If there are FDB's which are used to set up constants or data as opposed to addresses, they should not be changed, so type an 'N' in this case also. A common use for FDB's is to setup addresses for jump tables, command tables, etc. If your program has FDB's which setup addresses, but all those addresses are outside the range used for relocation, type an 'N' as they should not be altered. If the addresses are within the

range, you have two choices:

(1) If the locations of the FDB's themselves are within range, type a 'Y'.
(2) If the locations of the FDB's themselves are outside the range, type an 'O' or any other character.

Now you will be asked for the address of the FDB itself. You may enter as many FDB's as you like and they need not be in any order. When finished, type an 'FFFF' as an address to stop the input mode.

9. RELOCATION COMPLETED!! ... Self-explanatory!

LOADING FROM TAPE:

The TSC 6800 RELOCATOR has its own tape load routine which will read Motorola Mikbug format tapes. As each record is read, an offset is added to the record's loading address if that address is within the range of the program. When the LOAD subroutine is called, the first thing it does is turn on the reader control bit of the Mikbug control PIA. Next a string of control characters is sent out. The string is called TAPEON (at location $05AF) and is presently set to four nulls. If your tape system requires some special control characters, you may patch them into this string. DO NOT remove the '4' at the end, however. Similarly when the tape is completely loaded or when an error is received, the reader control bit of the Mikbug control PIA is turned off. Then a string called TAPOFF (at location $05B4) is sent out. TAPOFF is currently set to four nulls, but you may replace them with any control characters your tape system requires. Again, DO NOT remove the '4' at the end of the string.

Note that the LOAD routine is written as a subroutine and may therefore be called from another program if desired. Before calling it, however, you must setup an appropriate OLDPTR ($0213), OBJEND ($0217), OFFSTL ($021D), and OFFSTR ($021E). These would generally be set to $0000, $FFFF, $00 and $00 for a normal load operation.

FIXING REFERENCES:

It is not usually possible to directly move a program from one location in memory to another due to the extended references (the full 2 byte addresses in 3 byte instructions). For example, if you have an instruction which says JUMP to $1012, when the program is moved up by hex one hundred bytes it cannot stay the

same but must be changed to JUMP to $1112. This is what is meant by 'fixing references.' The TSC 6800 RELOCATOR searches thru the instructions as they are moved and any extended references are singled out. These extended addresses are then compared to the range begin and end and if inside the range, the proper offset is added to the address. Any references to outside the range are left unchanged so that jumps to external routines, calls to monitor routines, etc. will be properly relocated.

DATA BLOCKS:

Almost every program has areas which contain some type of data as opposed to executable code. When relocating, we must know where these blocks are for if we did not, there would be no way of knowing what was data and what was instructions. The instructions must have their extended references (the 2nd and 3rd bytes of 3 byte instructions) adjusted. The data must be transferred as is, byte for byte. This is the reason for specifying DATA BLOCKS. All bytes within the begin and end addresses specified (inclusive) will be relocated exactly as they are.

How do you know what should be specified as a 'DATA BLOCK'? If you have a source listing, it is generally quite easy. Any code generated by an RMB, FCB, FCC or FDB should be considered data. That's usually all there is to it! Of course if you wanted, instructions could be placed in a DATA BLOCK which would cause them to be relocated as is without fixing their references. Sometimes you may need to directly move a 3 byte immediate instruction. See the section titled '3 BYTE IMMEDIATE INSTRUCTIONS' for further details.

If you don't have a source listing, finding the data blocks becomes more of a problem. One solution is to put the object code thru a disassembler and then search out all data. Study the example relocations included for more insight.

3 BYTE IMMEDIATE INSTRUCTIONS:

There is one type of instruction which can cause problems for a relocator. That being a 3 byte immediate instruction of which there are three in the 6800 microprocessor:

LOAD INDEX REGISTER IMMEDIATE ($CE)
LOAD STACK POINTER IMMEDIATE ($8E)
COMPARE INDEX REGISTER IMMEDIATE ($8C)

In most cases the immediate bytes are an address. If that address is in range, it will be offset, otherwise it will be

directly relocated. This is the way it should be in almost all instances. You must keep an eye on the LDS command, however. Often one will say LDS immediate with an address outside the program, because you are setting up an external stack. Thus the stack will remain in the same place even though the program has been moved. If the stack is still out of the way, you have no problem, but it is something to look out for.

Another problem is in loading data into the index register or comparing the index register to data as opposed to an address. If the data is a number which is lower than the value of RANGE BEGIN or higher than the value of RANGE END, you have no problem. If, however, the data is a number inside the range, it will be altered as it looks like an address to the RELOCATOR. Although this does not occur often, it will give you an incorrect relocation.

To prevent these problems, you must know whether each occurence of a 3 byte immediate instruction contains immediate data or an immediate address. If it is an address, there will likely be no problem. If it is data, you should setup all 3 bytes of the instruction as a 'DATA BLOCK' as described above.

ADAPTING TO YOUR SYSTEM:

Adapting to your particular system is a very simple task. You must supply two routines. One is an output routine which outputs the A accumulator to your display and returns without affecting any other registers. The second is an input routine which inputs a character from your keyboard into the A accumulator and returns without affecting any other registers. You must patch the addresses of these routines into the RELOCATOR at $0220 and $0223. Upon completing a relocation, the program will jump to the address stored at MONITR ($0226). You may patch any address you like here, such as the re-entry point of your monitor. If you are using a MIKBUG monitor, these 3 addresses are already set and need not be altered.

You may need to alter the location of the stack which is presently setup at $0FFF. If this location is inconvenient for your particular system, you may change it by patching in the desired address at $0201 in the RELOCATOR.

See the section titled 'LOADING FROM TAPE' for instructions on adapting to your particular tape system.

SAMPLE RELOCATIONS:

1) The TSC 6800 Relocator

This sample will relocate the TSC 6800 RELOCATOR itself. The program starts at $0200 and ends at $06AF Let's assume we want to move it to $3200. Here is a copy of what the prompts and responses look like:

Rel. Ver. 1
for 4800

```
                * TSC 6800 RELOCATOR *
                PRESENT PROGRAM.
0200            BEGIN ADDRESS? 200
0716              END ADDRESS? 6AF
4800                   MOVE TO? 3200
                FIX REFERENCES? Y
4800            LOAD FROM TAPE? N
                DATA BLOCKS? Y
                  ..
0206            BEGIN ADDRESS? 206        9A06
021E              END ADDRESS? 21E        9A1E

                BEGIN ADDRESS? 5B1        9DB1
05B1              END ADDRESS? 6AF        9EAF
06D3
0707            BEGIN ADDRESS? FFFF
0716            ALTER RANGE? N
                FIX FDB'S? N


                RELOCATION COMPLETED !!!
```

Note that the stack remains at $0FFF. It may be necessary to change its location. The stack is set immediately upon entering the program. Thus in the relocated version, it is set at $3200. The instruction there is an LDS #. Change the $0FFF there if necessary.

2) TSC Space Voyage

SPACE VOYAGE actually begins at $0000 and ends at $0FFE. The first part is temporary storage in page 0, however, and cannot be moved. We will relocate only the program beginning at $0100. Let's assume we want the program moved to $1000. This relocation has an example of FDB's. They make up a jump table and thus are addresses. The FDB's themselves are outside the range, however, so an 'O' must be typed in response to the prompt, 'FIX FDB'S?' Here is what the relocation of SPACE VOYAGE looks like:

```
* TSC 6800 RELOCATOR *
PRESENT PROGRAM:
BEGIN ADDRESS? 100
  END ADDRESS? FFE
      MOVE TO? 1000
FIX REFERENCES? Y
LOAD FROM TAPE? N
DATA BLOCKS? Y

BEGIN ADDRESS? C35
  END ADDRESS? FFE

BEGIN ADDRESS? FFFF
ALTER RANGE? N
FIX FDB'S? O
ADDRESS? D5
ADDRESS? D7
ADDRESS? D9
ADDRESS? DB
ADDRESS? DD
ADDRESS? DF
ADDRESS? E1
ADDRESS? E3
ADDRESS? E5
ADDRESS? E7
ADDRESS? FFFF


RELOCATION COMPLETED !!!
```

9

3) Disassembler

```
BEGIN ADDRESS: 1900
  END ADDRESS: 1F14

   DATA BLOCKS? Y
    BEG ADDR: 197A
    END ADDR: 199A
              [1A94
              [1AB3
              [1BF9
              [1F14

FIX FDB'S? Y
ADDRESS: 1A94
         1A96
         1A98
         1A9A
         1A9C
         1A9E
         1AA0
         1AA2
         1AA4
         1AA6
         1AA8
         1AAA
         1AAC
         1AAE
         1AB0
         1AB2
```

MAKING THE TSC EDITOR AND ASSEMBLER CO-RESIDENT:

Following is a description of the steps necessary to relocate the TSC TEXT EDITING SYSTEM, allowing co-resident operation with the TSC 6800 MNEMONIC ASSEMBLER.

1) Load the RELOCATOR
2) Move it to $3200 and set its stack pointer to $3FFF (location $3201 after relocation must be changed to $3F)
3) Load the TSC TEXT EDITING SYSTEM
4) Load the program called 'LAS' which has been included with this documentation. Type in all code generated by that progra
5) Relocate the Editor-LAS pair according to the instructions given below. (Begin execution of the RELOCATOR at $3200)
6) Load the TSC 6800 MNEMONIC ASSEMBLER
7) Begin execution at $1700. See the LAS program for instructions on use and on adapting to a system larger than 16K.

RELOCATING THE EDITOR-LAS PAIR:

```
BEGIN ADDRESS: 0200          1700
  END ADDRESS: 1559          1359
      MOVE TO: 1700          2A59
                        NEW END =
```

```
DATA BLOCKS? Y
BEG ADDR: 0212
END ADDR: 0354
        [044C
        [044D
        [0458   [1491
        [045E   [14D2
        [0464   [150D
        [0470   [1512
        [0476   [1525
        [0482   [1532
        [0946   [1558
        [0955   [1559
        [0982
        [0988
        [0A31
        [0A47
        [0BF2
        [0C07
        [0C77
        [0C86
        [0D7F
        [0DCA
        [0FCA
        [0FD3
        [10B4
        [10CF
        [1241
        [125B
```

```
ALTER RANGE? Y
BEGIN ADDRESS: 01FF
  END ADDRESS: 1559

FIX FDB'S? Y
ADDRESS: 021B    02CE
         021F    02D2
         0228    02D9
         022C    02E4
         0235    02EA
         023C    02F4
         0241    02F8
         0245    02FF
         024E    0305
         0252    030C
         025B    0310
         0261    0316
         0268    031C
         026C    0320
         0272    0329
         027B    032D
         027F    0335
         0288    0339
         028C    033D
         0292    0344
         0299    0348
         029E    0949
         02A5    094F
         02AF    0953
         02B4    1245
         02B8    124C
         02C2    1252
         02C6    1259
```